Missouri
Department of
Natural Resources

AIR POLLUTION CONTROL PROGRAM

MISSOURI LEAD MONITORING NETWORK PLAN

October 2009

CONTENTS

EXECUTIVE SUMMARY

On October 15, 2008, the United States Environmental Protection Agency (EPA) revised the level of the primary National Ambient Air Quality Standard (NAAQS) for airborne lead from 1.5 micrograms per cubic meter ($\mu g/m^3$) to 0.15 $\mu g/m^3$, calculated as three-month rolling averages.

At the same time, EPA revised airborne lead monitoring requirements to require, at a minimum, monitoring in areas potentially impacted by sources of lead emissions greater than or equal to one ton per year. These source-oriented monitors must be operational by January 1, 2010. Identified sources include the Herculaneum, Glover, and Buick smelters and the mine/mill complexes at Buick, Brushy Creek, Fletcher, and Sweetwater, all operated by the Doe Run Company. In addition to these Doe Run sources, there are areas of former lead mining and processing in Missouri that have remaining waste materials that contain lead and are also candidate areas for airborne lead monitoring.

The proposed lead monitoring network includes ten (10) new sites in addition to existing sites in the Herculaneum area. Each of these sites will be operated every sixth day on the standard schedule.

- Herculaneum Area: Modify the current network to relocate all state samplers outside of the revised facility fence line, and expand the geographical extent of the network to better define the extent of the area of nonattainment of the new standard. The net number of state sites would increase by one (1).

- New Lead Belt and Related Facilities: Establish five (5) new State monitoring sites in the vicinity of the Buick Smelter and four mine/mill facilities in the Viburnum Trend area; establish one (1) new State site in the Glover area.

- Old Lead Belt Area: Establish two (2) new state monitoring sites, one in St. Joe State Park near tailings areas used for off-road vehicle activity, and one in Park Hills near remediation activity at the National Site.

- Tri-State Mining Area: Establish one (1) new state site near remediation activity on the Oronogo/Duenweg site in southwest Missouri.

The lead monitoring plan was submitted to EPA on July 1, 2009, following a 30-day public comment period. A revised plan was submitted to EPA on August 31, 2009 that included specification of almost all sites, responses to EPA comments and to other comments to the extent practicable, more discussion of the evaluation of emission estimates, review of sources with estimated emissions as low as one-half ton per year of lead, and monitoring results through the end of 2008. This document is a second revision to that plan and includes specification of all recommended sites. A table of latitude and longitude coordinates of monitoring site locations is included as an appendix. The monitoring recommendations have not changed significantly, so that this revision is essentially the same plan with more supporting information and greater detail and specificity. Site installation must be completed before the end of December of 2009. In

addition to the ten new sites listed above, the 2010 lead monitoring plan will call for establishing a new lead monitoring site in the Kansas City area by January 1, 2011.

1.0 INTRODUCTION

1.1 LEAD NAAQS, MONITORING REQUIREMENTS

On October 15, 2008, the United States Environmental Protection Agency (EPA) revised the level of the primary (health-based) national ambient air quality standard (NAAQS) for airborne lead from 1.5 micrograms per cubic meter ($\mu g/m^3$), to 0.15 $\mu g/m^3$, measured as total suspended particulate matter (TSP). EPA changed the calculation method for the averaging time to use rolling three-month periods with a maximum (not-to-be-exceeded) form, evaluated over a three-year period. This replaced the previous use of calendar quarter averages. A rolling three-month average considers each of the 12 three-month periods associated with a given year, not just the four calendar quarters within that year.

At the same time, EPA revised monitoring requirements to assess compliance with the new standards. State and local monitoring agencies will be required to conduct monitoring, taking into account lead sources that may exceed the standards. At a minimum, monitors must be placed in areas potentially impacted by sources of lead emissions greater than or equal to one ton per year. EPA Regional Administrators may waive the source-oriented monitoring requirements if the monitoring agency can demonstrate that emissions from the source will not contribute to maximum air lead concentrations greater than 50 percent of the revised standard, or 0.075 $\mu g/m^3$. These newly-required source-oriented monitors are to be operational by January 1, 2010. A monitoring plan must be submitted to EPA by July 1, 2009 for implementation of this source-oriented monitoring. This document is the required plan for source-oriented monitoring for the State of Missouri.

EPA will also require a monitor to be operated in each of the 101 urban areas with populations greater than 500,000 to gather information on general population exposure to airborne lead. These urban area samplers must be operational by January 1, 2011. A monitoring plan must be submitted to EPA by July 1, 2010 for implementation of this urban area monitoring. This document briefly describes current and planned urban area monitoring in Missouri. More detail will be included in a revised plan by July 1, 2010.

This section summarizes the recent changes in the lead NAAQS and monitoring requirements. Details may be found in the **Federal Register**, Vol. 73, No. 219 (November 12, 2008), p. 66964. This Federal Register notice and other information are available on the internet (http://epa.gov/air/lead/actions.html).

1.2 LEAD MINING AND PROCESSING IN MISSOURI

"Historic lead and zinc mining in the Midwest was centered in two major areas: the Tri-State area covering more than 2,500 square miles in southwestern Missouri, southeastern Kansas, and northeastern Oklahoma and the Old Lead Belt covering about 110 square miles in southeastern Missouri. The first recorded mining occurred in the Old Lead Belt in about 1742. The production increased significantly in both the Tri-State area and the Old Lead Belt during the mid-1800s and

lasted up to 1970. Currently production still occurs in a third area, the Viburnum Trend, in southeastern Missouri."
(http://www.epa.gov/epawaste/nonhaz/industrial/special/mining/chat/fsr67-607.pdf)

"Lead mining exploration in Missouri began with French explorations along the Meramec River and in the rugged St. Francois Mountains of southeastern Missouri in about 1700. In 1720, Philip Renault led an expedition that resulted in the opening of Mine La Motte in Madison County. The first mines were mostly surface diggings done by manual labor with pick and shovel. By 1725, Old Mines and Mine Renault were opened in Washington County. In subsequent years, lead mining was conducted on a small scale in St. Francois County (beginning about 1742) and Mine a' Burton (1763) at present day Potosi in Washington County. It was not until 1842 that the Valle Mines were opened in northern St. Francois County. The Civil War fueled an increased need for lead. St. Joe Lead Company was formed in 1864 to open and operate the Bonne Terre Mine and Flat River Mine in St. Francois County. The mines throughout this Old Lead Belt area ranged from surface mines to mines that extended several hundred feet below the ground surface. Production of these early mines was sufficient to meet needs for about next 100 years. The only mine of significance to be opened during this period was the Annapolis Mine, which opened in 1915.

"By the 1940s, lead reserves in the Old Lead Belt on the eastern side of the St. Francois Mountains were seriously depleted and the exploration for new lead reserves moved to the western side of the St. Francois Mountains. Economic ore bodies are not near the ground surface in this area, but are present at depths ranging from about 500 feet to 1,500 feet below the ground surface. Lead ore was discovered near Eminence in the late 1950s, and in the Viburnum Trend area in the 1960s. The Viburnum Trend discoveries were shallower and were, therefore, developed first. Ten mines were eventually opened in the Viburnum Trend from the extreme southern edge of Crawford and Washington Counties to west central Reynolds County. The mines include Viburnum 27, Viburnum 28, Viburnum 29, Casteel, Magmont, Buick, Brushy Creek, West Fork, Fletcher, and Sweetwater."
(http://mo.water.usgs.gov/mining/minehistory.htm)

Current activity includes mining at six mines in the Viburnum Trend area (as mentioned above) and milling at four mills located at four of the mine sites, primary lead smelting at Herculaneum, lead ore concentrate shipment by truck from mill sites to the smelter and to the Southeast Missouri Port Authority near Scott City, Missouri, and transfer to barges for shipment on the Mississippi River at the same port. Current activity also includes operation of a secondary smelter at Buick Missouri for recycling and purification of lead used in storage batteries. All of this activity is performed by the Doe Run Company, a successor to the historic St. Joe Lead Company.

Recent and current activity also includes remediation of waste material (chat piles and tailings ponds) in both the Tri-State and Old Lead Belt areas. Because of the large volumes of waste material, remediation generally consists of stabilization of material and covering with other material to prevent offsite migration by either wind or water action.

1.3 EXISTING LEAD MONITORING NETWORK AND PAST MONITORING RESULTS

The airborne lead concentration has been measured at multiple locations in Missouri in the past. Data from 1975 onward is available in the EPA Air Quality System (AQS). Past and current source-oriented measurements have been made in Jefferson, Iron, St. Francois, and Holt Counties, as discussed in Sections 3, 4, 5, and 7 below.

Lead monitoring has also been done at multiple sites in the past in the St. Louis and Kansas City areas. Figure 1-1 shows the maximum quarterly average lead concentrations measured in the St. Louis and Kansas City areas from 1975 through 2008 (when measurement results are available). This figure indicates a significant decrease in the lead concentrations in these areas over time. This decrease is consistent with the gradual reduction of lead in gasoline used as motor vehicle fuel, begun in the early 1970s, with significant reductions in 1985 and 1986, and complete elimination of lead in motor vehicle fuel gasoline at the end of 1996. Because of this decrease in airborne lead, monitoring has been reduced. The only lead monitoring in Missouri that is not in the source areas mentioned above and discussed in the following sections is currently at the Clayton Station in St. Louis County. Recent measurements at that site have been reported at half the detection limit or 0.05 $\mu g/m^3$, as may be seen in the figure.

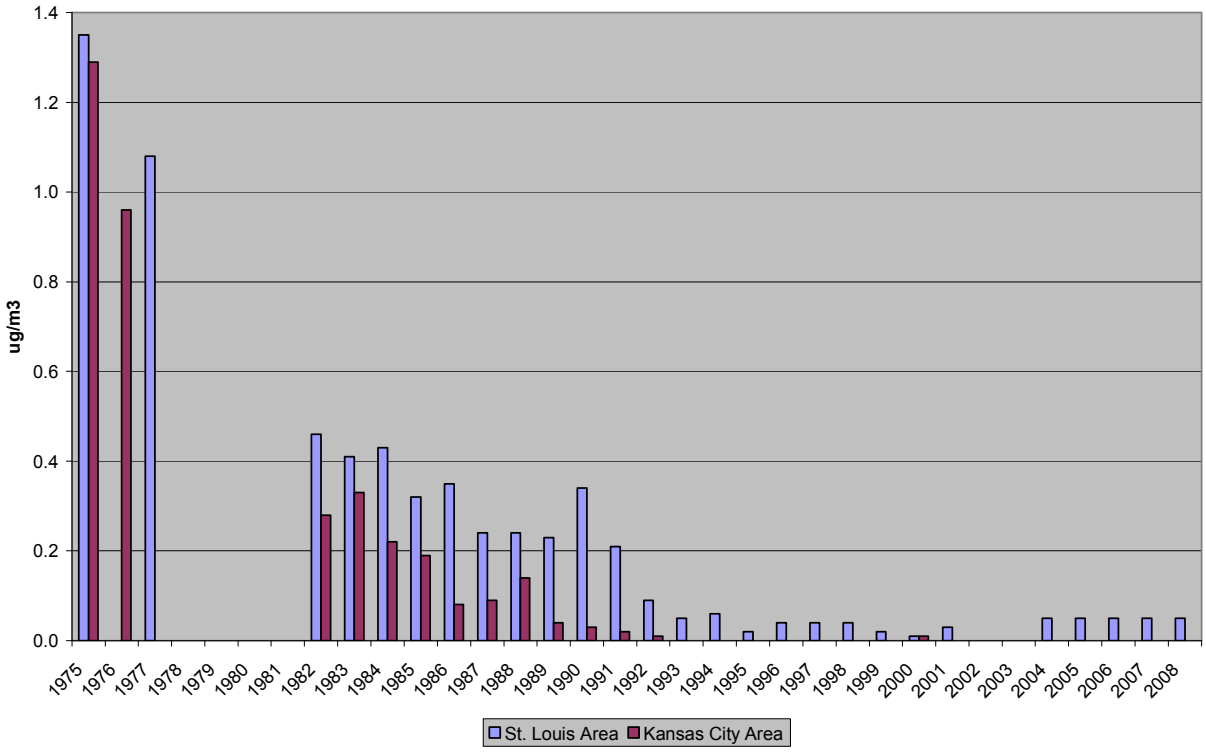
In addition to the St. Louis and Kansas City area sites and source-oriented sites, monitoring was also done in the past at multiple locations throughout the state in 1975 and 1976. Monitoring at these sites was generally discontinued in 1976 or 1977. All of these sites were in compliance with the old NAAQS, and these concentrations would be expected to be much lower at present (like those in the urban areas) because of the elimination of lead in gasoline.

1.4 WIND CHARACTERISTICS IN MISSOURI

Figures 1-2, 1-3, and 1-4 show wind roses from recent years for St. Louis, Kansas City, and Springfield respectively. Each lobe on a wind rose represents wind from one of 16 compass points. The length of each lobe represents the percentage of time that the wind is from a particular direction. The various colors show the percentage of time that wind from a particular direction is in a particular range of wind speed. The dominant feature of each of these wind roses is the high frequency of wind from the south (south-southeast at Springfield). Other notable features for St. Louis are the frequency of wind from the west to northwest, and the relative lack of wind from the northeast. The Kansas City and Springfield wind roses are both dominated even more strongly by winds from the south or south-southeast. The Kansas City wind rose shows relative lack of wind from the southwest or northeast. The Springfield wind rose shows relative lack of wind from the west or east.

In addition to regional characteristics shown in these wind roses, the topography in some of the areas discussed in the following sections, especially the Glover area and Viburnum Trend areas, would be expected to effect wind flow. Hills and valleys lying in a general north-south direction would be expected to enhance the dominance of south and north winds.

Figure 1-1. Highest Quarterly Average Lead Concentration in Area



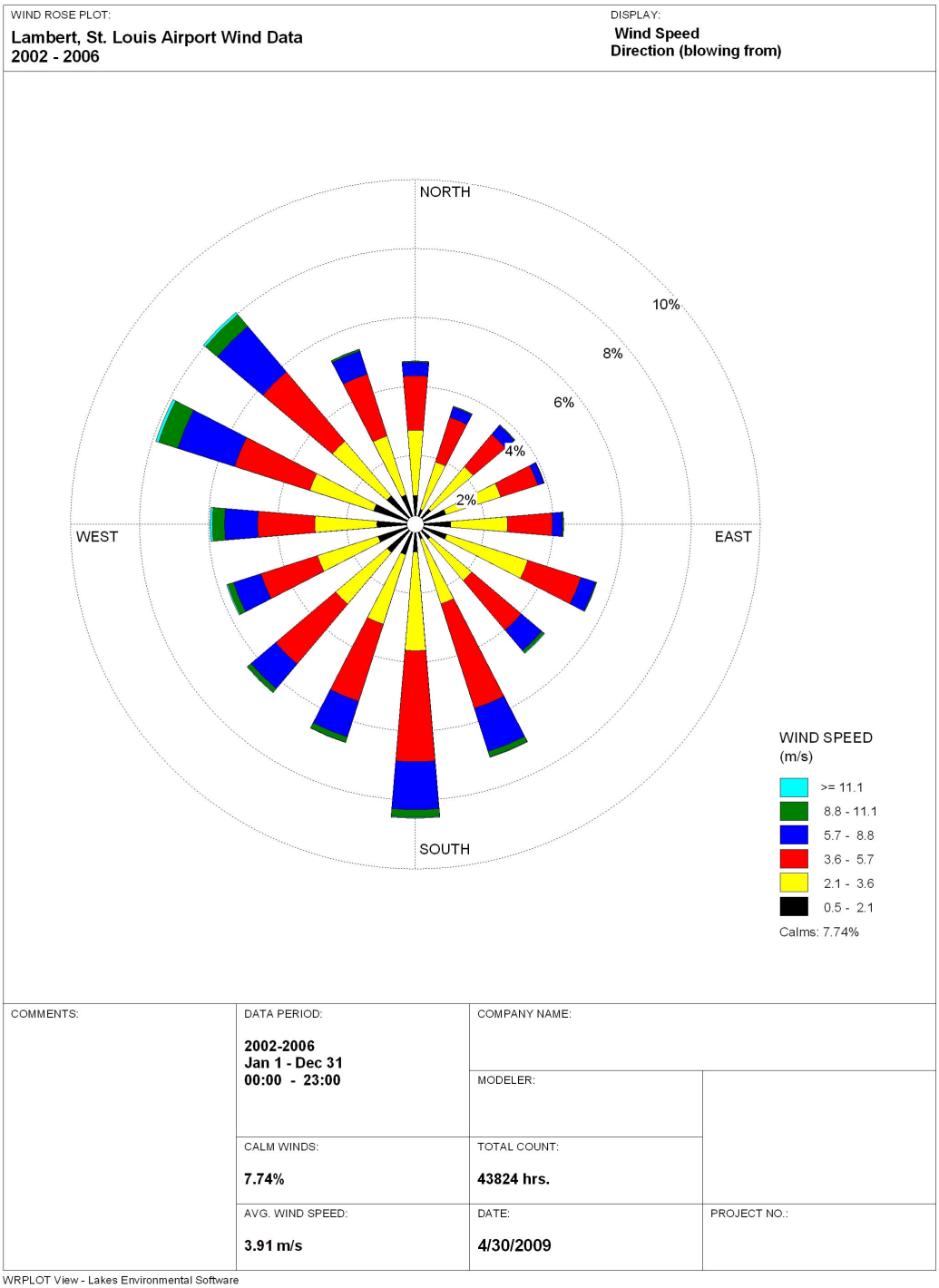


Figure 1-2. St. Louis Wind Rose.

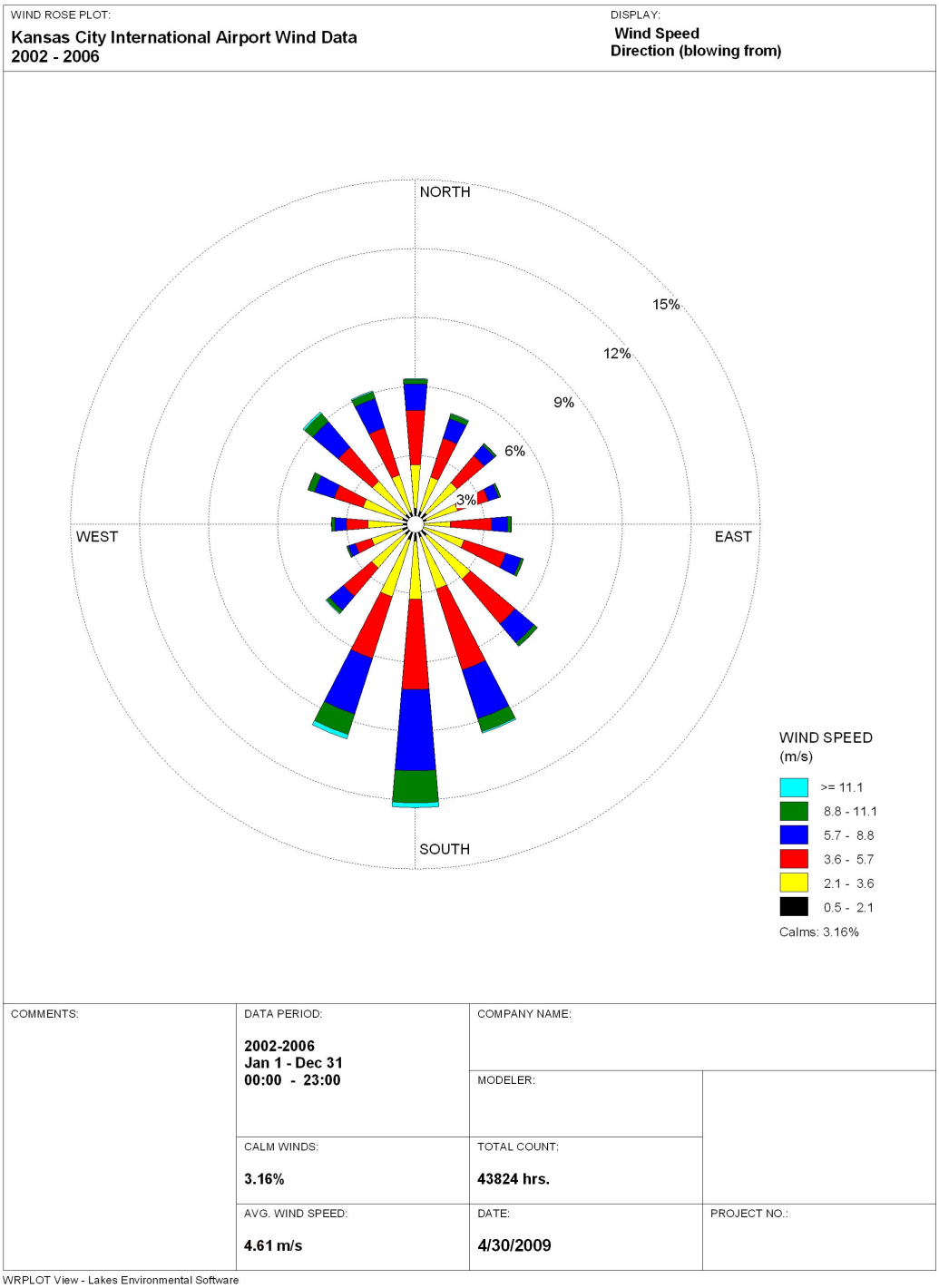


Figure 1-3. Kansas City Wind Rose.

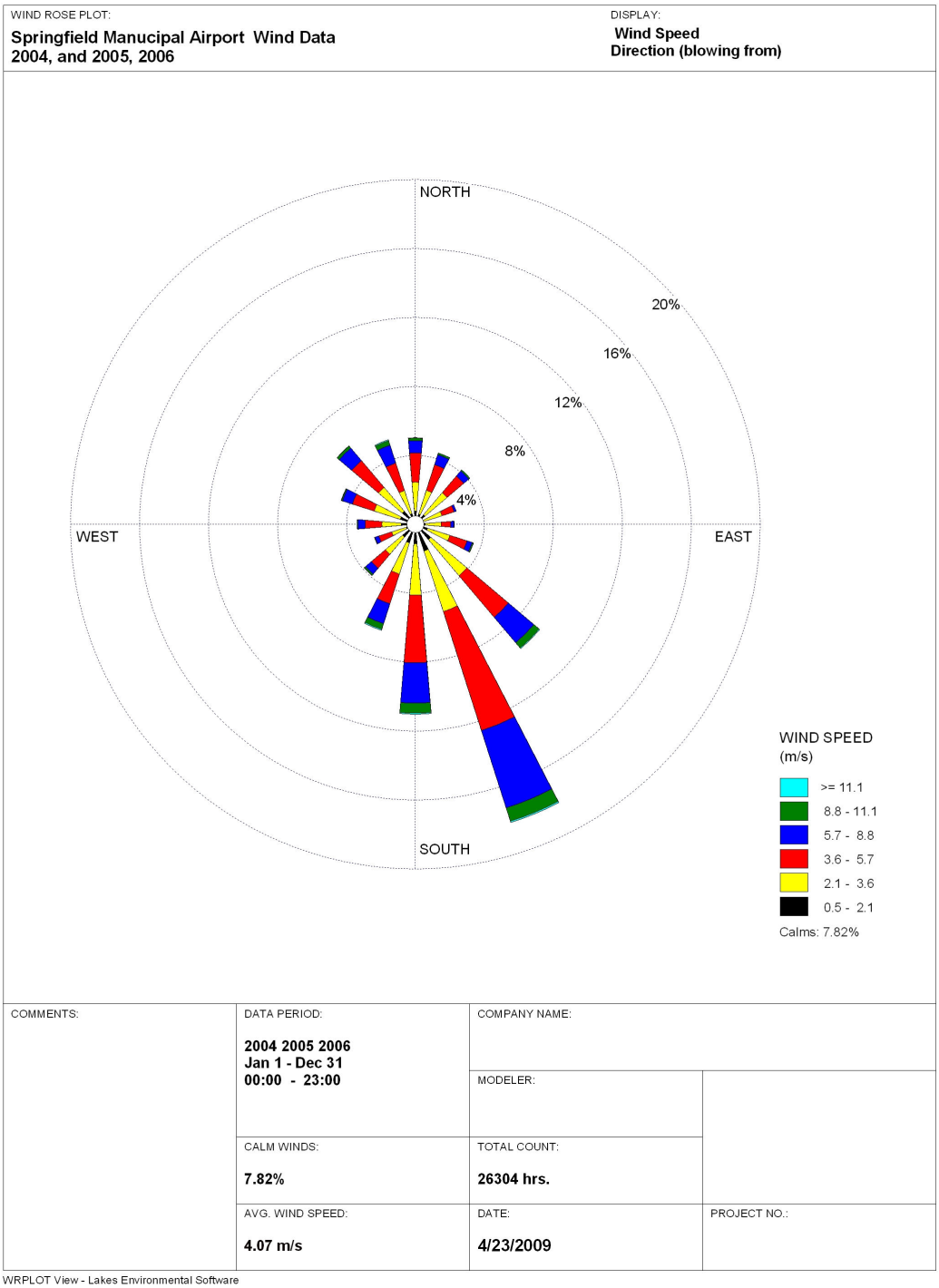


Figure 1-4. Springfield Wind Rose.

2.0 IDENTIFICATION OF ONE TON PER YEAR SOURCES

Emission inventory data in the MDNR APCP MoEIS system and the National Emission Inventory (NEI) and Toxic Release Inventory (TRI) have been reviewed to identify lead sources in Missouri that have been reported as historically emitting one-half ton per year (TPY) or more. After detailed review and recalculation of lead emissions, exemptions were requested from EPA for all facilities that did not trigger the one ton limit. These facilities (with one exception) had source test results to support the lower, but more accurate lead emissions. These facilities can be categorized as either initially using a higher lead emission factor (EF) to be conservative or being unaware of the source of the higher NEI or TRI value, which conflicted with the approved source test data. None of the exempted facilities were related to lead mining, milling, or primary smelting. Table 2-1 lists these facilities that were eliminated from further consideration as one-half-ton-per-year emitters and a brief summary of the reason for elimination for each source. Revised lead emission estimates were based on application of an appropriate emission factor (City Utilities), reliable source test results (Exide Technologies), or use of other credible approaches. River Cement used an inappropriate worst case factor in the previous reported emission estimate, and Continental Cement installed a new kiln system with improved control efficiency.

Table 2-1. Potential Lead Sources Eliminated from Further Consideration

Source	Reason for Elimination and Recalculated Emission Rate
City Utilities, Springfield	Incorrect emission factor (EF) used previously. Appropriate AP42 and FIRE factor (0.00042 lbs/ton) was used to calculate correct value. Revised Pb=0.01 TPY; previously 1.25 TPY.
Exide Technologies	Reported emissions confirmed from MDNR approved stack test. Facility unaware of higher NEI value (see also Section 7.0). Revised Pb=0.01 TPY; previously 2.11 TPY from NEI.
River Cement Company	Lead EF based on 1996 test with lead injection for worst case analysis. EF derived from dust samples yields less than 0.05 TPY. Revised Pb=0.05 TPY; previously 1.95 TPY.
Holcim Clarksville	Reported emissions confirmed from source test. Facility unaware of higher NEI value. Revised Pb=0.09 TPY; previously 1.97 TPY from NEI.
St. Louis MSD	Source tests on 2 of 4 incinerators (corroborated by tests on 6 similar incinerators) yield lead EF 2.5% of AP42 value. Revised Pb=0.026 TPY; previously 1.06 TPY.
Continental Cement	Reported emissions confirmed from source test. Facility unaware of higher NEI value. Revised Pb=0.06 TPY; previously 0.60 TPY from NEI.
Holland USA	No reported lead emissions in MoEIS from 1992-2008.
Miles Mobay (Bayer Cropscience)	Reported lead emissions in MoEIS 0.04 TPY in 1994, 0.01 TPY in 1995, zero in other years 1992-1993 and 1996-2008.
Empire Asbury	Average lead emissions in MoEIS 1998-2008, 0.13 TPY, maximum 0.17 TPY.
Fort Leonard Wood	No reported lead emissions in MoEIS from 1992-2008.

The remaining sources are all related to lead mining and milling, primary lead smelting, or secondary lead smelting. Table 2-2 lists the identified sources and reported emission estimates for recent calendar years. All of the listed sources are operated by the Doe Run Company and include the four operating mills and four of the six operating mines in the Viburnum Trend area. Doe Run states that emissions from the Sweetwater facility in recent years have been less than one ton per year, but emission estimates for these complex facilities are uncertain, and, as indicated by the reported emissions for 2002-2004, that facility has the capability of emitting more than one ton per year. Monitoring at these sites is discussed in the following sections.

Table 2-2. One Ton or Greater Per Year Lead Emission Sources and Reported Emissions

Site	Year/Emissions (tons per year)					
	2002	**2003**	**2004**	**2005**	**2006**	**2007**
Buick Mine/Mill	15.48	16.49	17.27	6.58	4.24	5.47
Glover Smelter*	14.78	14.33	*	*	*	*
Buick Smelter	11.00	7.16	7.01	7.28	4.03	33.71
Herculaneum Smelter	58.80	25.13	25.95	28.09	26.42	21.81
Sweetwater Mine/Mill**	3.20	1.88	2.07	**	0.73**	0.57**
Brushy Creek Mine/Mill	13.71	12.83	9.66	3.20	2.70	2.26
Fletcher Mine/Mill	13.43	13.20	11.74	3.67	3.63	2.87

*Operation of the primary lead smelter at Glover was suspended in December 2003, and it is currently in maintenance status. However, some lead ore has been more recently stored at the facility, and smelter or other operation may be resumed or begun in the future at Glover.

**The Sweetwater mine/mill operating permit allows for reduced reporting, so that emissions were not reported for 2005-2007. However, it is currently operated at about half the throughput of the Brushy Creek or Fletcher facilities, so has the capability of being a greater-than-one-ton emitter, as indicated by the 2002 to 2004 emissions. Emission estimates shown for 2006 and 2007 were provided by Doe Run in their comments on this plan and have not been verified. Doe Run's estimated emissions for these facilities may now be even lower, based on revised emission factors for mine vents (see Section 4).

3.0 HERCULANEUM LEAD MONITORING

3.1 Existing Lead Monitoring Network and Past Monitoring Results

Airborne lead monitoring is done near the primary lead smelter in Herculaneum, Missouri both by MDNR ESP and by the Doe Run Company. MDNR ESP operates samplers at:

- Bluff
- Broad Street
- Circle Street
- Dunklin High School (two collocated samplers through August 2008)
- Main Street (two collocated samplers starting September 2008)

The Doe Run Company operates samplers at:

- Bluff
- Broad Street
- Church Street (two collocated samplers)
- Circle Street (discontinued at the end of September 2008)
- Dunklin High School (two collocated samplers through March 2008)
- Main Street/City Hall
- Mott Street
- Sherman Drive
- South Cross Street
- North Cross Street

Locations of these sites are shown in Figure 3-1.

The Doe Run Company has acquired and fenced land adjacent to the smelter, so that the Broad Street and Circle Street sites are now inside the facility fence line (shown as a yellow or orange line in Figure 3-1). However, monitoring at the Broad Street site is a requirement of the State Implementation Plan (SIP) for the Herculaneum area, as are monitoring at the Main Street/City Hall site and the Dunklin High School site, which are still in ambient air outside the facility fence line. Doe Run Company monitoring at Circle Street was discontinued at the end of September 2008.

Figures 3-2 and 3-3 show three-month rolling average airborne lead concentrations (calculated as per the new NAAQS) measured at these sites for November 2005 through December 2008. Results are plotted on the time scale at the final month for each three-month period. In other words, results plotted at "March" are for the January-February-March period, etc. Results for collocated samplers, whether operated by the same organization or by the two different organizations, are in very good agreement. The figures also show the level of the new lead NAAQS, 0.15 $\mu g/m^3$ (three-month rolling average). Except for a few results at the Bluff and Sherman Drive sites, almost all of these results would be above the level of the new NAAQS if it were applied retroactively.

3.2 Recommendations for Network Changes

A network of sites was originally configured which was adequate to determine the areas of noncompliance or compliance with the old lead NAAQS (1.5 $\mu g/m^3$, calendar quarter average). It has been expanded and revised over the last fifteen years for various reasons, and while most sites still have some benefit, others may be redundant, and there also may be locations where relocated monitoring could be helpful. One concern is the lack of extent to determine the area of noncompliance with the new lead NAAQS. The network is a very dense one, particularly near the smelter, much more so than is deemed necessary to determine compliance or develop control strategies. While careful monitoring in the area is clearly of prime importance, a network that is more suited to understanding the current air quality, particularly with implementation of new SIP controls and the likelihood of further compliance work, would be beneficial to all.

Figure 3-2 and 3-3 demonstrate, really without exception, that monitoring results measured near the smelter operation correlate with higher lead concentrations. This has been the pattern for ambient concentrations throughout the history of sampling at Herculaneum for the last 25 years. Close monitoring sites in particular have been the predictor of design values, with Broad St occupying that place while it was in ambient air, and the Doe Run Main Street/City Hall site taking that distinction since the fencing changes. Ambient levels since the most recent SIP controls appear to continue that pattern. Of interest in comparing Main Street monitoring results to Circle Street results is that concentrations have been similar since the most recent SIP revisions. This continues the overall pattern of sites close to the smelter showing higher concentrations. Concentrations at the Bluff site are considerably lower, similar to levels at Dunklin High School, which is approximately the same distance from the smelter as the Bluff site. Finally, the Sherman site shows values slightly less than Bluff.

These comparisons allow us to see that changes to the network will accomplish the goals of determining compliance, and providing information for future planning. Of first importance is determining the air quality just beyond the property fence line, as history tells us that is where the highest concentrations will most likely be found. The Circle Street site is now within the facility fence line, and the fence line is being moved farther out in that area. Therefore the Dunklin High School site will be near the new fence line and will serve the purpose of determining the air quality just beyond the fence line.

In the locations north of the smelter, the Bluff and Dunklin High School sites provide similar well-correlated data. Given the similar distances, it is reasonable to infer that over time, future planned controls will be similarly effective at both sites. The Sherman Drive site shows slightly lower values than those at Bluff or Dunklin High School, although still generally at levels above the new standard. For these reasons, the Bluff site should be discontinued, and the MDNR Bluff sampler should be relocated to Sherman to provide state monitoring at that location.

In addition, monitoring should be established farther north than the Sherman Drive site in order to help define the extent of the area not attaining the new standard. Two sites are recommended, one at the formerly-utilized Pevely site and one farther to the north, also in Pevely. Locations of these sites are indicated in Figure 3-4.

An upwind site near the Ursuline Provincialate (south of the smelter facility) was established some years ago; however, that site could never be maintained adequately. Upwind monitoring at this time may be very important to determine background levels as planning for the new, much lower standard is developed. For this reason, an MDNR site to provide background measurements should be established to the south of the smelter, south of Joachim Creek and at an elevation similar to that of the smelter. The recommended site is near the Ursuline Provincialate but at a different location than the old site; the new recommended site will meet siting criteria. The location of this recommended site is indicated in Figure 3-5.

The following MDNR sites should be continued: Dunklin High School and Main Street. It has been proposed that the Dunklin High School site should be relocated from the building roof to a ground level location on the school site. However, a suitable ground level location has not been determined, and the sampler will continue to be operated in its present location on the building roof..

Maintenance of monitoring by MDNR at Broad Street and Circle Street (discussed above) are no longer necessary, because these sites are no longer located in ambient air. Doe Run is maintaining sampling at Broad Street as part of its control plan, which is adequate.

With regard to sites that Doe Run alone is operating, results from the Doe Run Company sampler at Mott Street correlate well with those from Main Street (see Figure 3-6), with values consistently lower than Main Street results. The sampler is very close to the Main Street site, and it does not provide information that is of benefit in either informing compliance or developing plans. The Mott Street sampler should be eliminated.

Results from the North Cross and South Cross Street samplers agree well, with the North Cross site showing slightly lower concentrations, likely because of the hill to the east of that site. Because data from the North Cross site is used in support of implementation plan activities, the South Cross site should be eliminated, and the Church Street and North Cross Street sites should be maintained.

Finally, the Doe Run City Hall sampler is marginal in meeting siting criteria, because it is in a somewhat low-lying area with higher terrain between the facility and the site, and because of a tree near the sampler. It should be moved closer to the MDNR Main Street site, which tends to monitor higher values. Data for both samplers is being submitted under the same site code.

The network of sites in the Herculaneum area remains sufficiently dense to monitor airborne lead impacts from truck haul routes. Future plans may include construction of a new bridge across Joachim Creek and a revised haul route. When that route is implemented, the monitoring network will be reviewed to ensure adequate monitoring near the haul route.

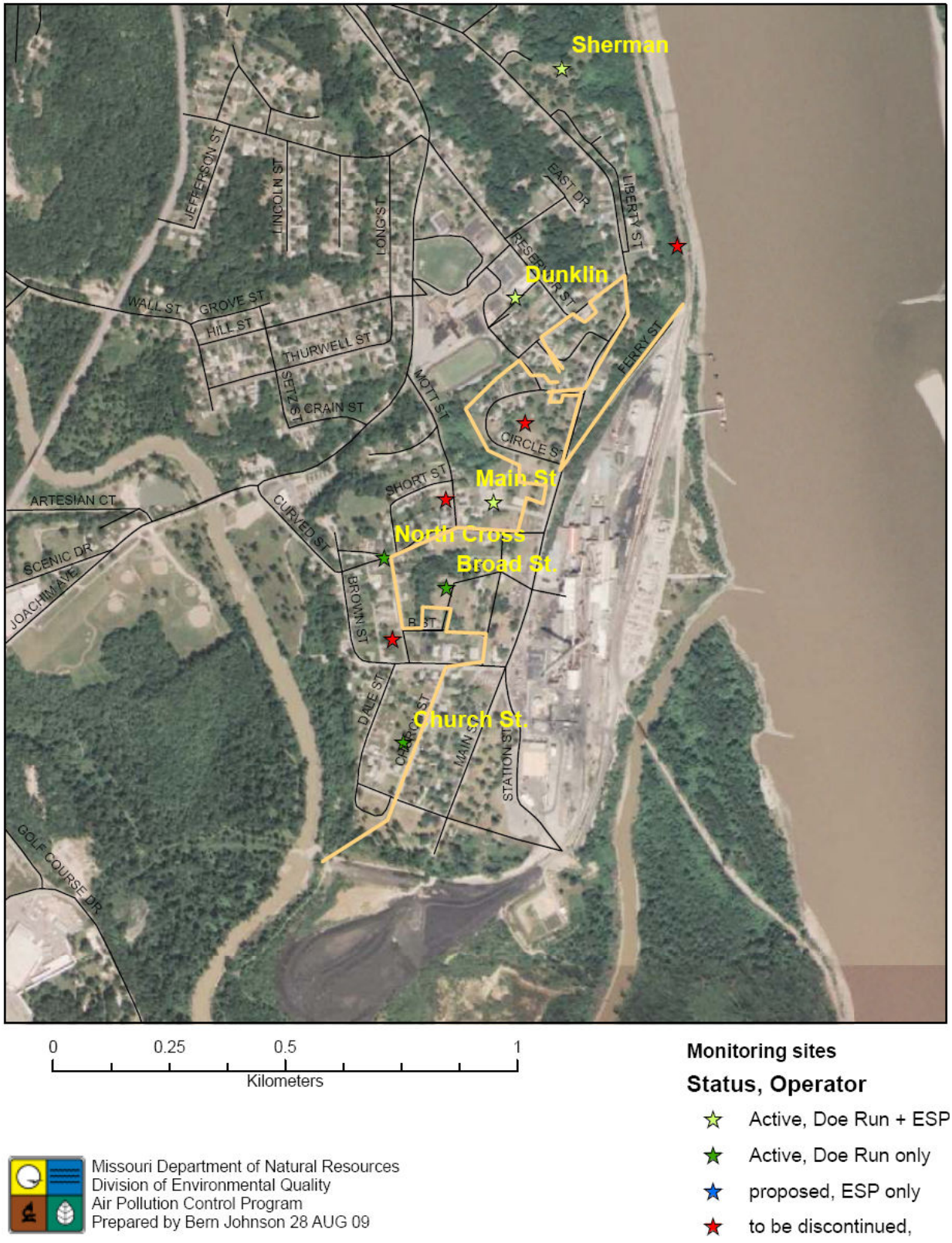


Figure 3-1. Herculaneum facility fence line and monitoring sites, not including two new north sites and the new south site. The four sites to be discontinued (red stars) are, from north to south, Bluff, Circle, Mott, and South Cross.

Figure 3-2. ESP Herculaneum Airborne Lead Concentrations, 3-Month Rolling Averages (plotted at third month)

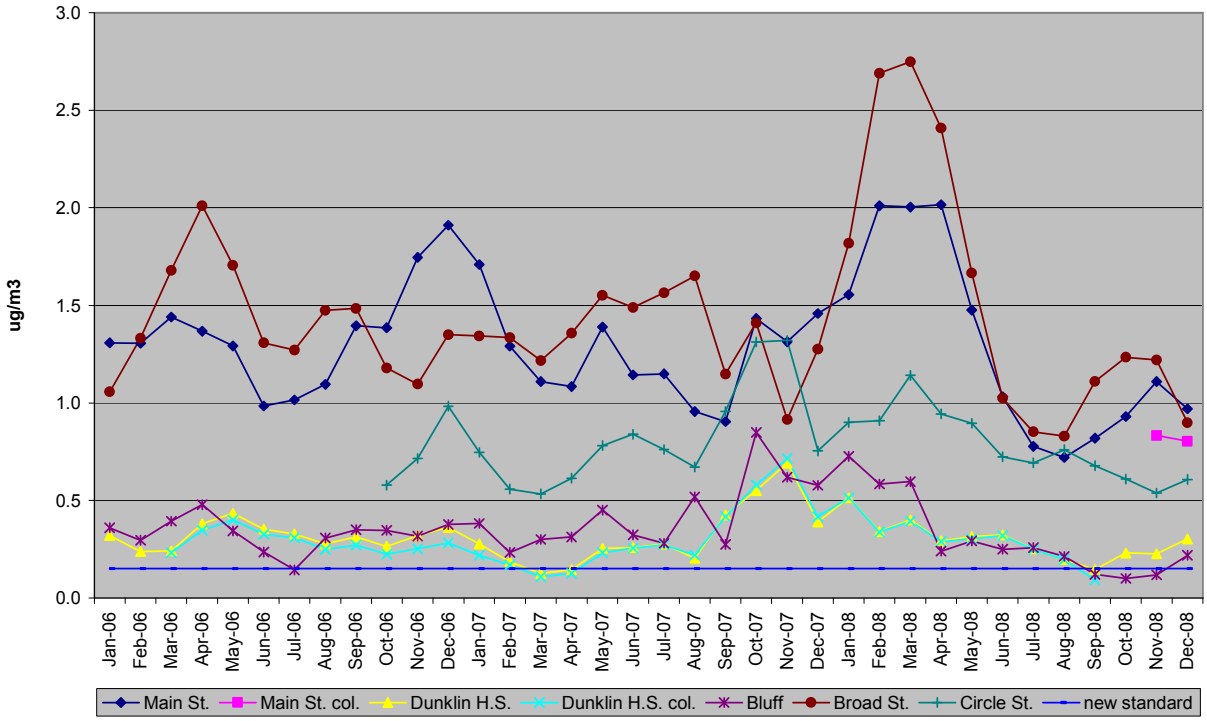
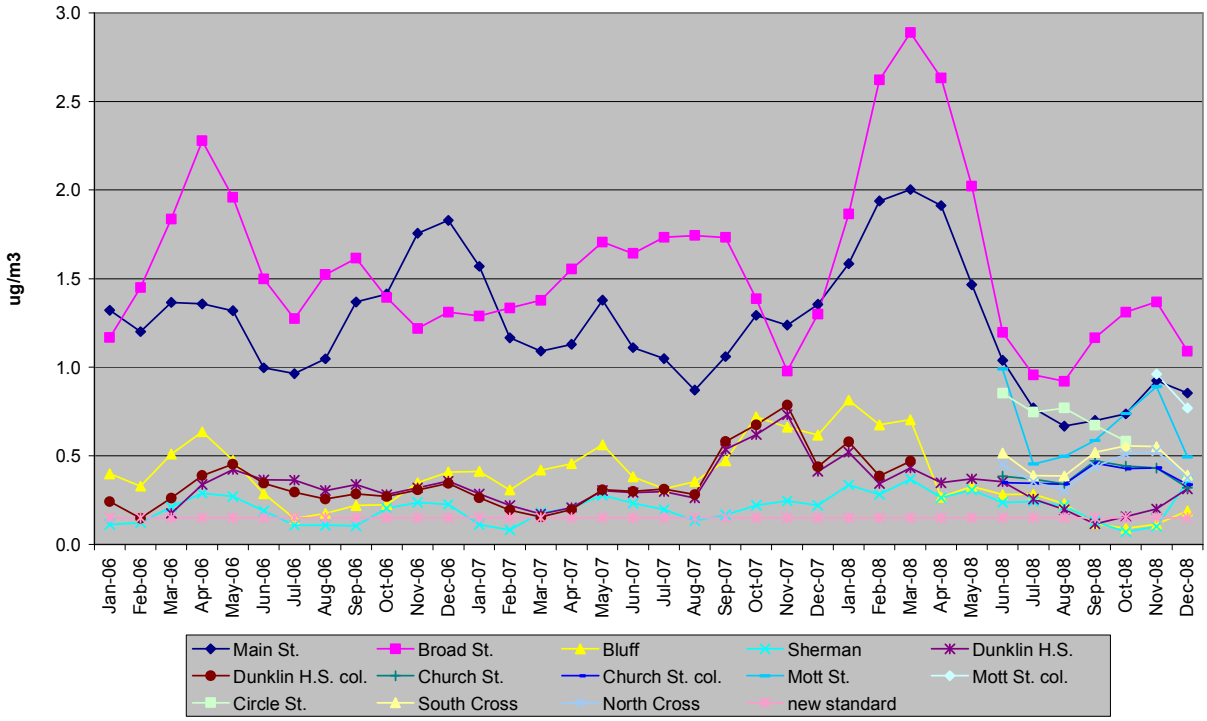
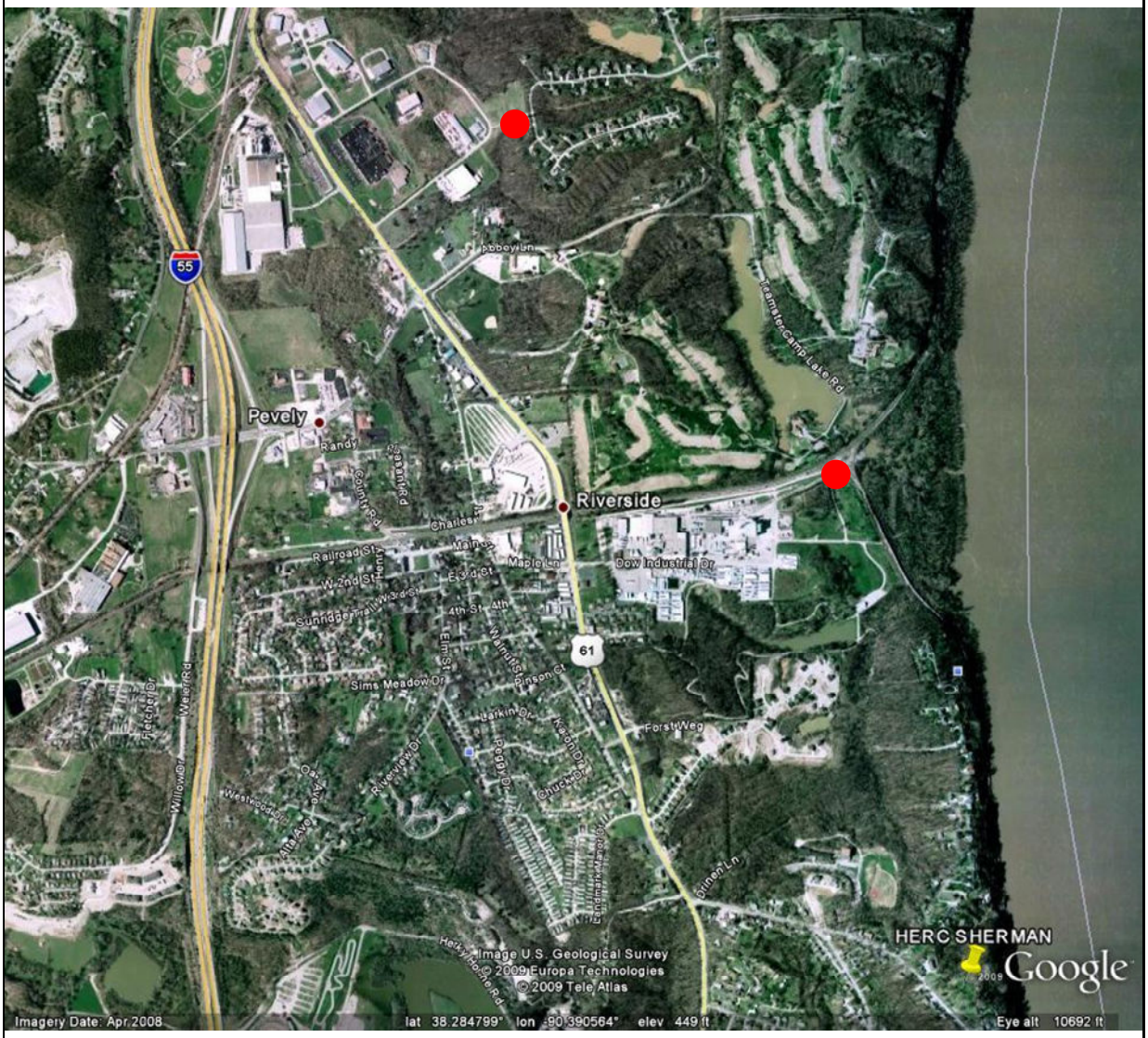


Figure 3-3. Doe Run Herculaneum Airborne Lead Concentrations, 3-Month Rolling Averages (plotted at third month)





● Figure 3-4. Recommended Pevely and Pevely North sites.

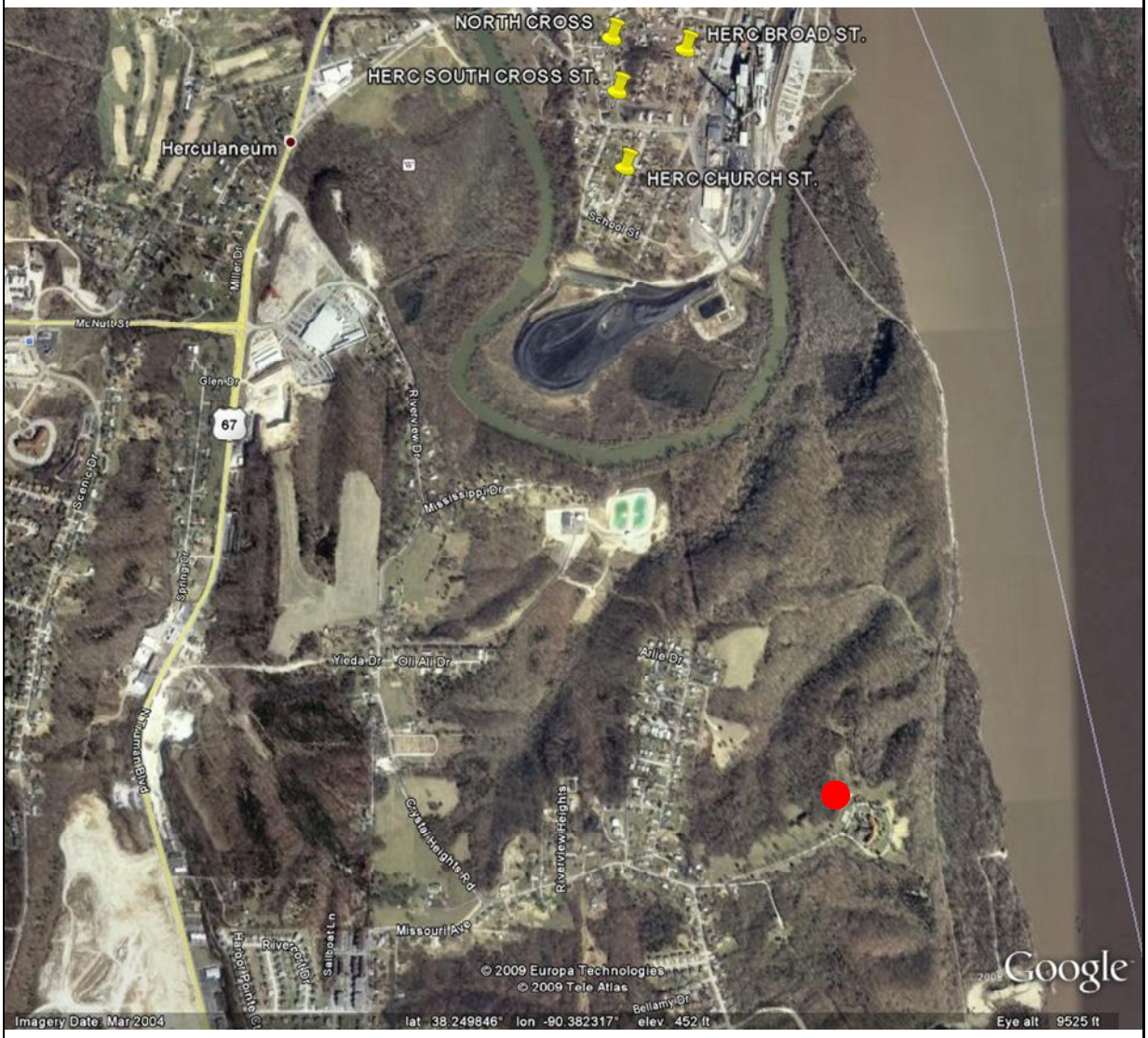
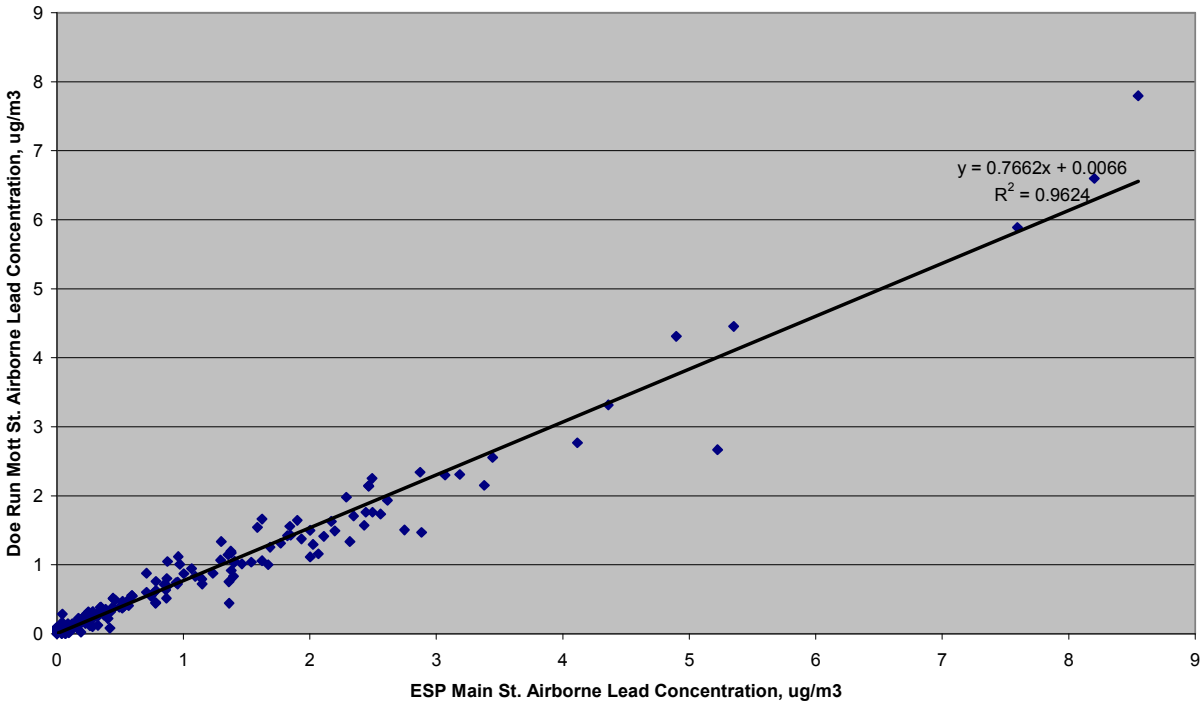


Figure 3-5. Recommended south site.

Figure 3-6. Correlation of Mott St. and Main St. Airborne Lead Concentrations, 24-hour measurements, April-December 2009



4.0 NEW LEAD BELT AND RELATED FACILITIES

4.1 Buick Smelter

The Buick Smelter, located near Boss and Bixby, Missouri in Iron County is a secondary smelter used for recycling lead primarily from lead-acid storage batteries. It is operated by the Doe Run Company's Resource Recycling Division. Much of the surrounding area is heavily forested and within the Mark Twain National Forest. Other large areas of land near the Smelter are either owned outright by the Doe Run Company or the company has surface mining rights. These facts provide some challenges with regard to siting ambient monitors.

4.1.1 Existing Lead Monitoring Network and Past Monitoring Results

The Doe Run Company operates two lead monitoring stations near the Buick Smelter, one approximately 1.2 miles to the north, called Buick North, and one approximately 0.8 mile to the south, called Buick South, with two collocated lead samplers. Both stations were in compliance with the previous lead NAAQS of 1.5 $\mu g/m^3$ until a recent upset at the plant caused a violation of that standard in the fourth quarter of 2008. Figure 4-1 shows the approximate locations of these sites and of the Buick Smelter. Figure 4-2 shows three-month rolling average airborne lead concentrations (calculated as per the new NAAQS) measured at these sites for November 2005 through December 2008. Results are plotted on the time scale at the final month for each three-month period. Results would not be in compliance with the new NAAQS, averaging generally about four to five times the level of the standard, with fourth quarter 2008 data being an order of magnitude higher than the new standard.

4.1.2 Recommendations for Network Changes

Because of reported emissions from the Buick Smelter (Section 2.0) and because of recent lead monitoring results at concentrations exceeding the level of the new standard, it is recommended that MDNR ESP begin monitoring at two locations near the Buick Smelter but not on Doe Run Company property. Because prevailing wind directions are north-south, one site should be to the north and one to the south of the facility. Because of the local topography and lack of development in the area, suitable locations are somewhat difficult to find. The recommended location is adjacent to the lumber mill on the north side of State Highway 32, across the highway from the current Doe Run Buick North site. This location is indicated in Figure 4-1.

4.2 Viburnum Trend Mine and Mill Sites

As discussed in Section 2.0, the Doe Run Company operates six underground lead mines in the Viburnum Trend area. Mills are located with four of the mine sites, which are the sites identified as having greater than one ton annual lead emissions. There are tailings ponds, portions of which

are dry, associated with each of these facilities. These sites, from north to south, are: Buick, Brushy Creek, Fletcher, and Sweetwater. These sites are located in Iron and Reynolds Counties.

4.2.1 Existing Lead Monitoring Network, Past Monitoring Results, and Modeling Results

Ambient air lead monitoring has not been done in the past in the vicinity of the mine/mill sites. The Doe Run Company has recently conducted monitoring at a location near the Brushy Creek facility, not as an ambient monitor, but for the purpose of evaluation of air quality modeling results for the mine/mill facilities. Results from that site for a short period and results of air quality modeling for the mine/mill facilities were not available when this plan was submitted on July 1. Modeling results for these facilities, performed by a contractor for Doe Run, using new emission rates for mine vents based on new measurements, were provided to MDNR on July 27. These modeling results indicate that, for two of the four mine/mill facilities (Brushy Creek and Sweetwater), the predicted maximum three-month average lead concentration is greater than one half of the standard only within the facility boundaries. For the Buick mine/mill, the concentration isopleths for half the standard extend across highway KK at three locations, near the north and south mine vents and near the mine/mill facility. For the Fletcher facility, the concentration isopleth for half the standard extends to the north of the property boundary in an unpopulated forest area.

However, these facilities and associated operations are complex, and emission rates are uncertain. We continue to believe that monitoring near all four of these facilities is desirable. Also, near-source monitoring done by Doe Run for model evaluation adjacent to the Brushy Creek facility (and within property boundaries), was (for the six weeks reported) generally consistent with modeling results when averaged over a long enough time (one or two months). But, on one day, a lead concentration significantly greater than the modeled concentration was measured, suggesting the presence of unaccounted sources in the area or the influence of one or more of the other, more distant facilities.

4.2.2 Recommendations for Network Changes

Because of reported emissions from the mine/mill facilities, and because of the uncertainty in emission estimates, it is recommended that MDNR ESP begin monitoring at locations near these facilities. Because prevailing wind directions are north-south, monitoring locations will generally be to the north or south of facilities. Because of the local topography, significant forest cover, and lack of development in the area, suitable locations are somewhat difficult to find. Locations which have been identified (including the one discussed in Section 4.1 above) are:

- North of the Buick Smelter, near Highway 32 (as discussed above);
- South of the Buick Mine/Mill and northeast of the Brushy Creek Mine/Mill in an area along Highway KK (south of the Iron-Reynolds County line and north of highway J) where there are several residents;
- Near the Brushy Creek Mine/Mill, in the valley along Bills Creek to the west near the dam on the tailings pond;

- Northeast of the Fletcher Mine/Mill along Forest Route 2236, adjacent to the power substation about 1 mile from the facility;
- East-northeast of the Sweetwater Mine/Mill near Highway B, where there is a valley with some farms and residents.

Figure 4-1 shows the locations of these recommended monitoring sites, including one monitoring site near each of the four Mine/Mill facilities.

4.3 Glover Smelter

Operation of the primary lead smelter at Glover, Missouri was suspended in December 2003, and it is currently in "care and maintenance status" according to the Doe Run Company website (www.doerun.com). However, some lead ore has been stored in the past at the facility, zinc and copper concentrate from the mine/mill facilities is shipped by rail from Glover, and smelter or other operation may be resumed or begun in the future.

4.3.1 Existing Lead Monitoring Network and Past Monitoring Results

Airborne lead monitoring has been done at multiple sites near the Glover smelter in the past by both MDNR ESP and the Doe Run Company. Figure 4-3 shows monitoring results (calendar quarter average concentrations) from third quarter 1987 through third quarter 2008. Results are plotted on the time scale at the initial month for each quarter. In other words, results plotted at "January" are for the January-February-March quarter, etc. The Hogan, Dunn, and South sites were operated by MDNR ESP. The North, Post Office, Big Creek, and Chloride sites were operated by Doe Run Company (abbreviated in the figure legend as DRG N, DRG PO, DRG BC, and DRG CL). The Glover facility is located in a narrow valley that trends from North to South, and the monitoring sites, as listed in the legend, generally trend from north to south. Approximate locations of these monitoring sites are indicated in Figure 4-4. Results in Figure 4-4 clearly fall into three time periods with different ranges of lead concentrations: results through the end of 1996, results from 1997 through 2003, and results since 2003. In late 1996 the sinter plant was enclosed and ventilated under negative pressure, and some other operations at the facility were also enclosed. These changes resulted in the changes seen in the figure starting at January 1997. In December 2003, smelter operation was suspended, and this change resulted in the changes seen in the figure starting at January 2004.

Figure 4-5 shows the second and third time periods with expanded scales. Following the facility changes in late 1996, measured results indicated compliance with the old lead NAAQS (1.5 $\mu g/m^3$, calendar quarter average). The highest concentrations were observed at the DRG Big Creek site, south of the facility, and the nearby Dunn site. The DRG Post Office site, northeast of the facility, showed slightly lower concentrations. The other sites (Hogan and DRG North to the north, and South and DRG Chloride to the south) showed lower concentrations.

Monitoring at all but the DRG Post Office and Big Creek sites was discontinued following the suspension of smelter operations. Figure 4-6 show three-month rolling average airborne lead

concentrations (calculated as per the new NAAQS) measured at these sites for November 2005 2006 through December 2008, plotted at the final month for each three-month period. Results would be in compliance with the new NAAQS, averaging about half the level of the standard.

4.3.2 Recommendations for Network Changes

As just discussed, recent results at DRG monitoring sites indicate compliance with the new NAAQS. However, results are at a significant fraction of the standard, and operations at the facility may change in the future. Also, current sampling is being done by DRG, with laboratory analysis being done by an outside contract laboratory. Analytical detection limits potentially can affect the individual and monthly average concentrations, and it is possible that averaged concentration results will be higher if analysis is done according to the new Federal Equivalent Method that is being developed. In addition, more stringent precision will be required under the new standard. That is to say, analysis which is adequate to ensure compliance with the 1.5 $\mu g/m^3$ NAAQS may not be adequate under the new standard which is an order of magnitude lower. Because ensuring adequate detection and precision is more attainable under state agency monitoring and laboratory analysis, it is recommended that MDNR ESP resume monitoring at a location near, but outside the fence line of, the Glover facility. Because of the local topography and lack of development in the area, suitable locations are somewhat difficult to find. The recommended location is adjacent to the Glover Baptist Church (see Figure 4-4), about one-half mile north of the facility.

4.4 Southeast Missouri Port Authority

About half of the concentrated lead ore from the new lead belt mine/mill facilities is transported to the Herculaneum smelter for processing. The other half is transported to the Southeast Missouri Regional Port Authority (SEMO) near Scott City, Missouri, south of Cape Girardeau, where it is loaded onto barges to be transported on the Mississippi River to the New Orleans area. At New Orleans, it is transferred to larger ships and shipped out of the country. Transport to both Herculaneum and to the SEMO port is done with 18-wheel trucks with covered dump bed trailers.

The facility for unloading trucks and loading barges at the SEMO port has recently been upgraded. MDNR APCP staff visited the facility in March 2009 and observed truck unloading and washing, but not barge loading. Trucks are unloaded within a large building, and the lead concentrate is stored within the building.

Transfer of material to barges is done using a belt enclosed in a large (roughly 10 feet diameter) horizontal tube or pipe that extends from the building. At the end of the belt the material falls onto the barge through a flexible and length-adjustable nylon or plastic vertical tube with rubber flaps at the bottom. Air is drawn into the vertical tube and also into the end of the horizontal tube. A filter near the end of the horizontal tube filters the air from the vertical tube assembly, and the collected material is re-deposited onto the belt. A second filtration system (baghouse) filters much of the air drawn through the tube and exhausts into the building. When material is

being transferred to a barge, it is transferred from the pile inside the building into a hopper (also inside the building) at one end of the belt using a front-end loader, driven by an operator from inside an air-conditioned cab.

APCP staff did not observe transfer of material to a barge, but it would seem that, while emissions from along the belt and from the area above the barge would be minimal, loading of material from the pile into the hopper would be a potential source of emissions of lead-bearing dust. Railings and platforms inside the building were fairly dusty, consistent with this assumption. Some fraction of this material would presumably escape the building through the truck bay and other vents. Also, some dust might escape the building during truck unloading, although no visible emissions from the building were seen, and some dust might become airborne at the point of barge loading. In short, much of the operation seems to be well-controlled, and it is certainly an improvement over previous outdoor transfer directly from trucks to barges before the new facility was constructed, but there is still the potential for some emission of lead-bearing into the air. Emission rates from this operation would be difficult to estimate, since it is a specialized operation, or to measure, since emission points are not well-defined.

Ambient lead monitoring near the facility might, in principle, be desirable, but finding a suitable location would be difficult. The dominant wind direction is from the south, and the river at that location runs from west to east, so that a nearby ambient location to the north is not available. There is a point of land to the north of the channel where barges are loaded, but that point is within the port facility. Other land to the north is across the river in Illinois. A site to the south along K highway might be found, but the nearby area is wooded, and power may not be available. Therefore, lead monitoring near this facility is not being recommended at this time.

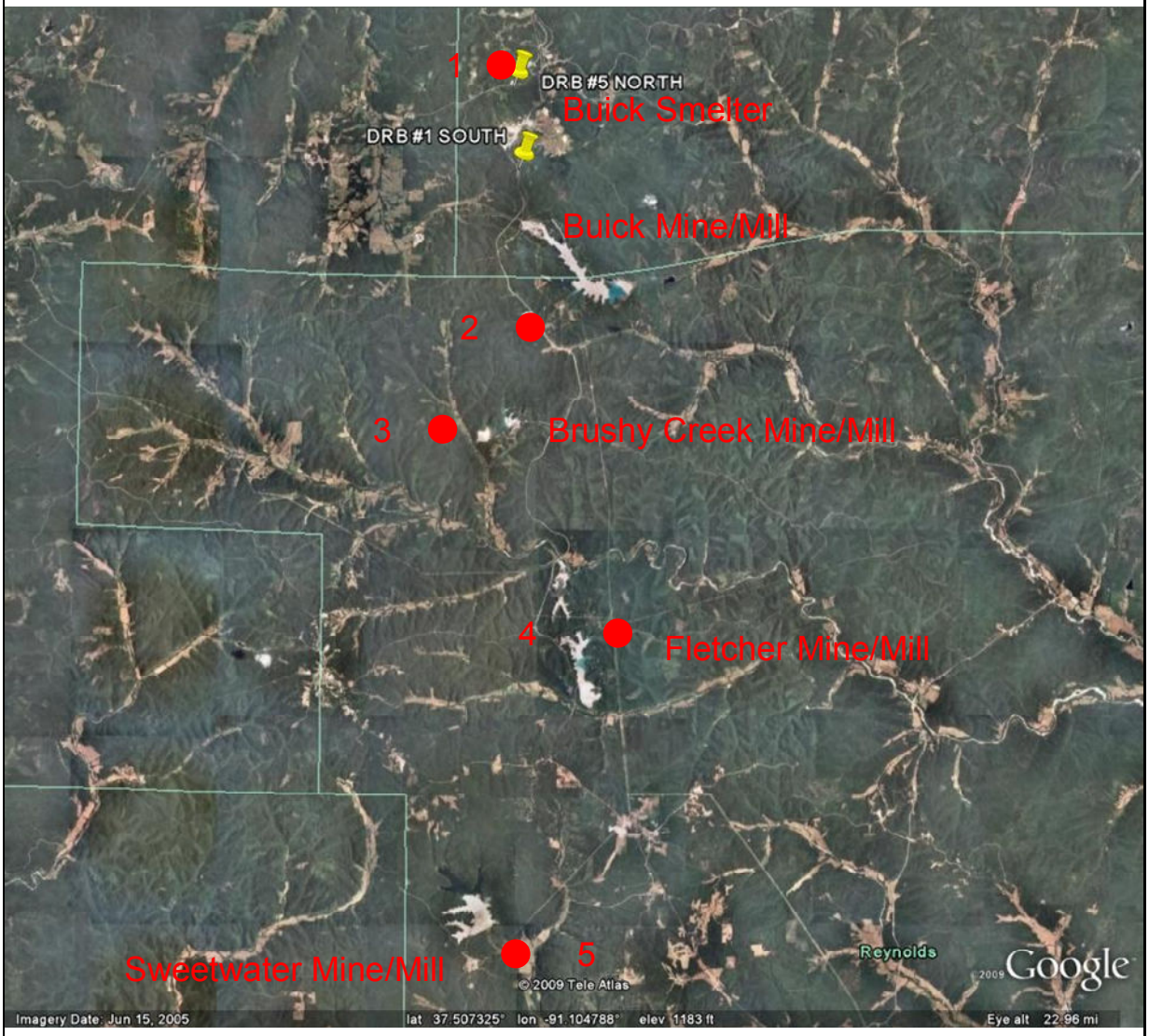


Figure 4-1. Doe Run Buick Smelter and Viburnum Trend mine/mill facilities, Present Doe Run Buick monitoring sites (yellow pins), and recommended sites (red dots). 1 Highway 32 north of Buick Smelter, 2 Highway KK south of Buick mine/mill, 3 Bills Creek near Brushy Creek, 4 Fletcher, 5 Highway B northeast of Sweetwater.

**Figure 4-2. Buick Airborne Lead Concentrations,
3-Month Rolling Averages (plotted at third month)**

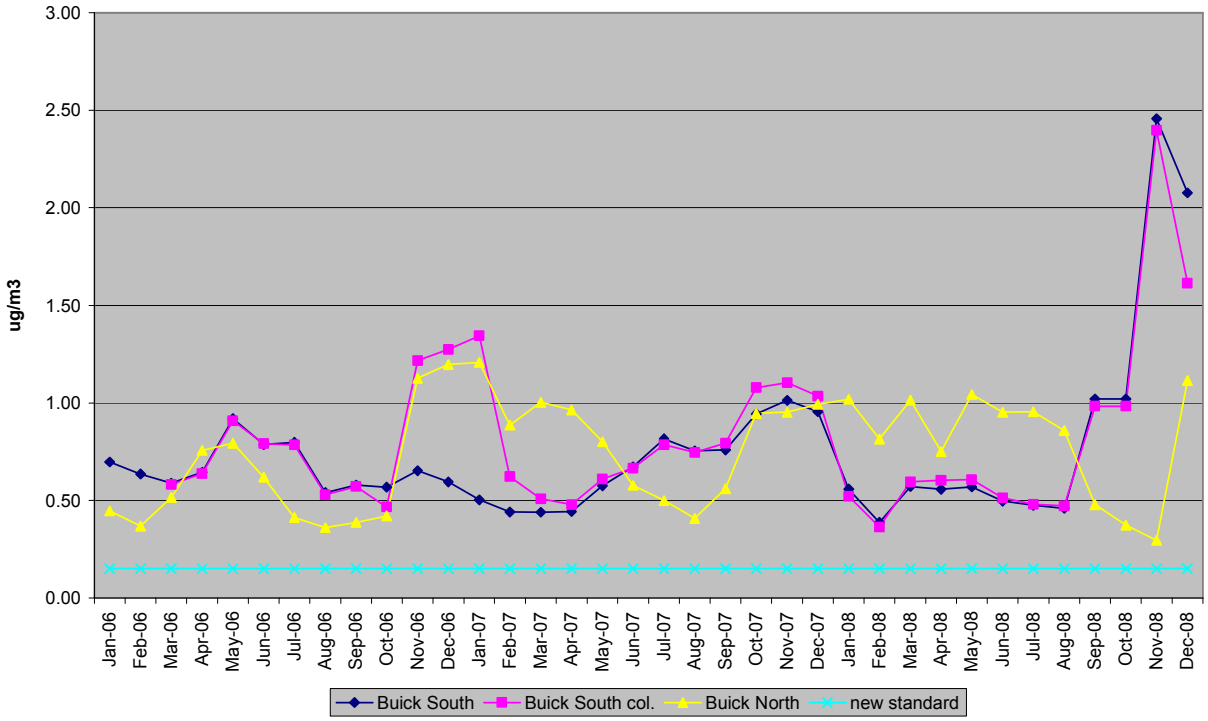


Figure 4-3. Glover Airborne Lead Concentrations, Calendar Quarter Averages

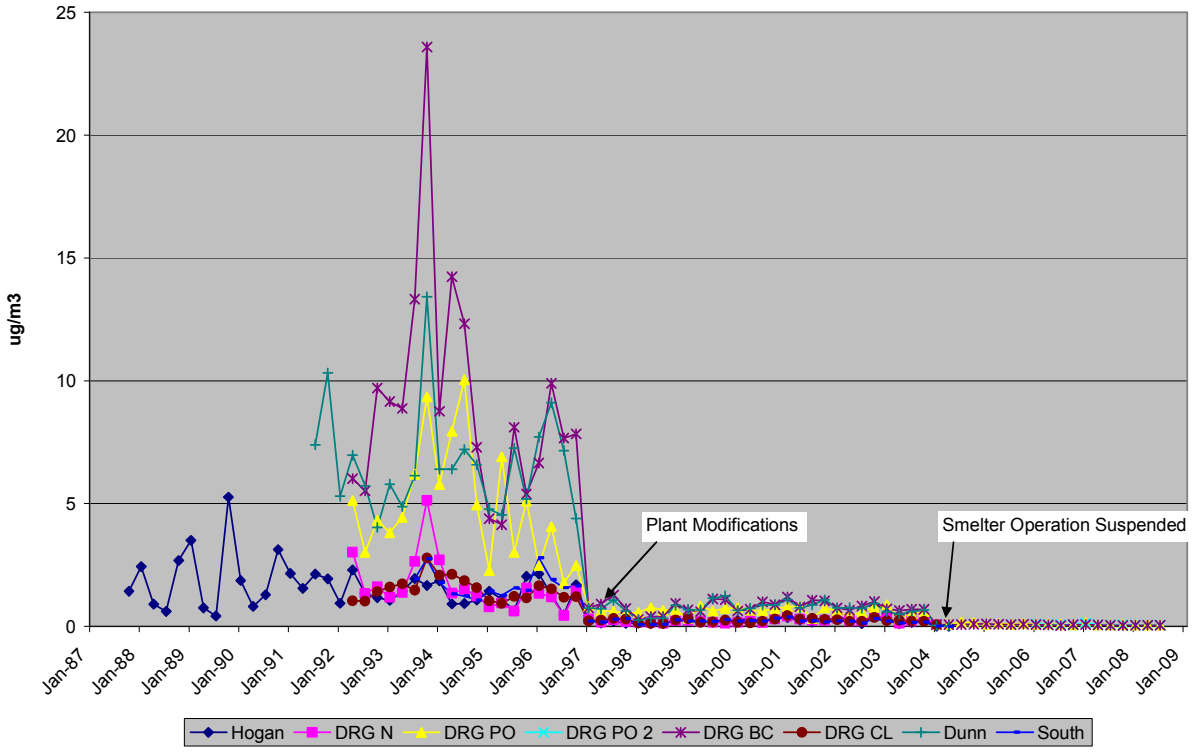


Figure 4-4. Past and present (DRG Post Office and DRG Big Creek) Glover sites (yellow pins), and a recommended site (Glover Baptist Church, indicated by the red dot) near the Doe Run Glover facility.

Figure 4-5. Glover Airborne Lead Concentrations, Calendar Quarter Averages

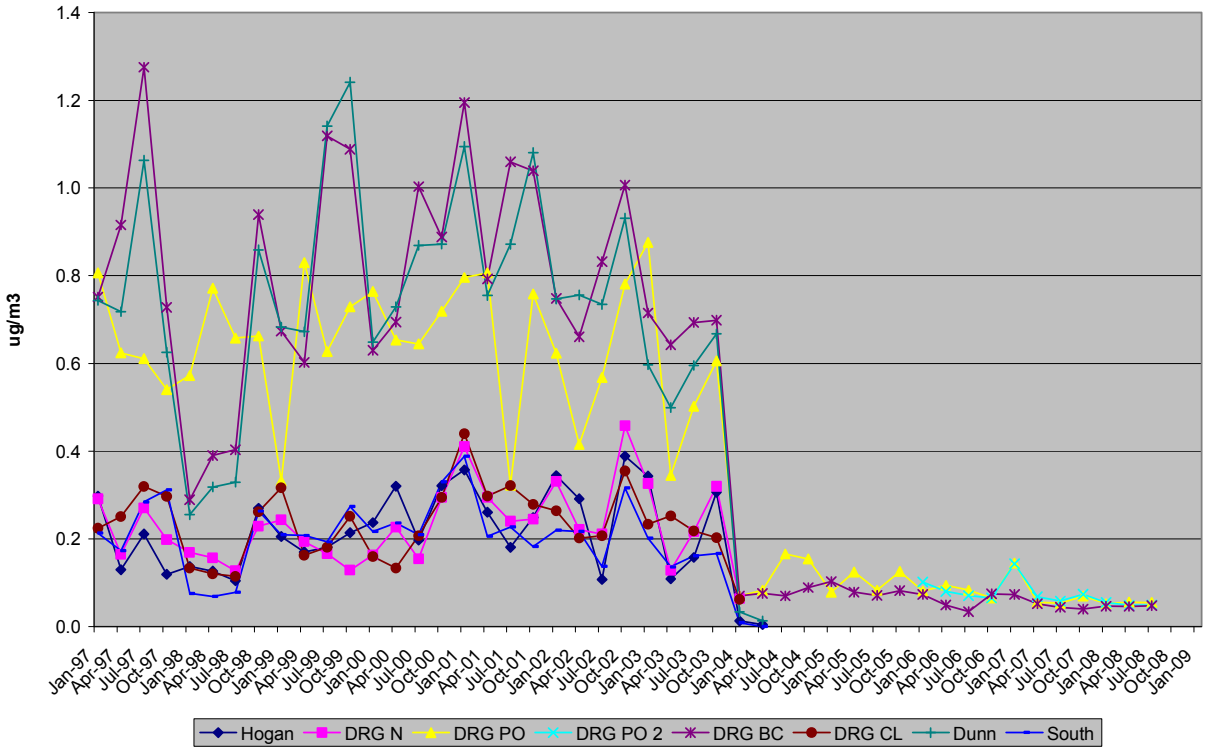
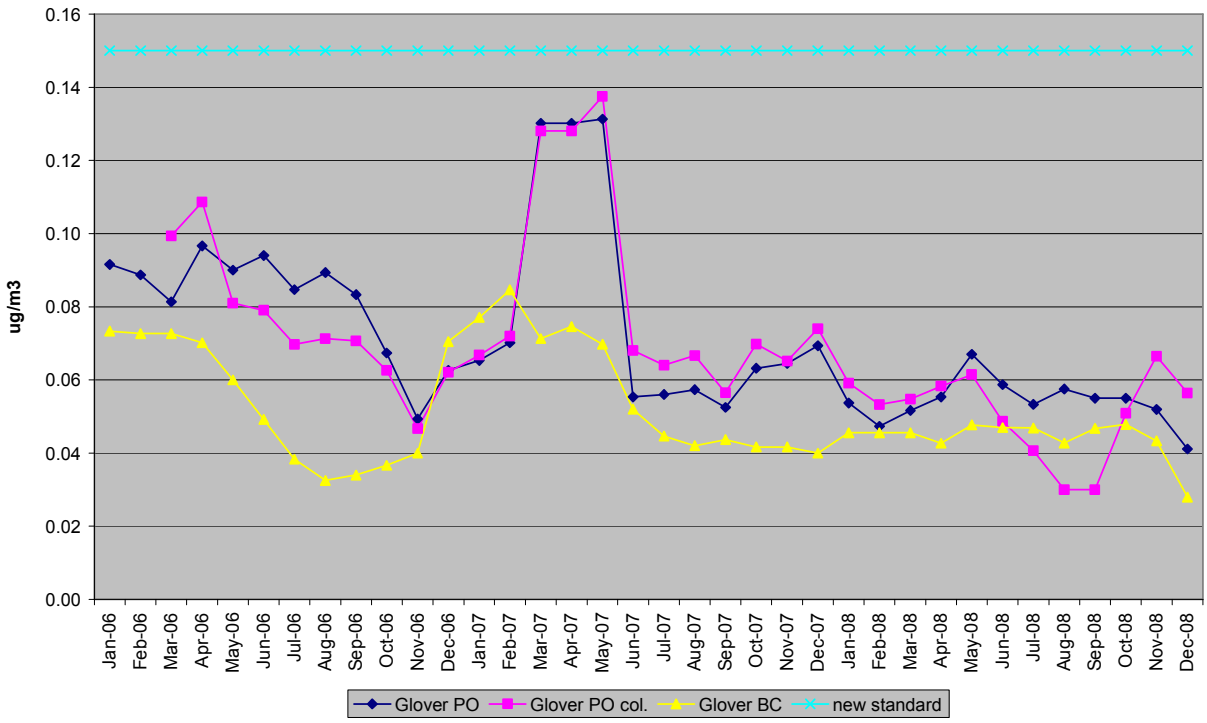


Figure 4-6. Glover Airborne Lead Concentrations,
3-Month Rolling Averages (plotted at third month)



5.0 OLD LEAD BELT

As discussed in Section 1.0, mining has been discontinued in the old lead belt area. However, chat and tailings disposal areas remain from the mining activity. The larger chat and/or tailings disposal areas include: Bonne Terre, Desloge or Big River, National, Elvins or Rivermines, Leadwood, and Federal, all in St. Francois County. Locations of these areas are shown on Figure 5-1. The Federal tailings area is located within St. Joe State Park, discussed below in Section 5.1. Remediation activities are currently underway at the National chat pile in Park Hills, Missouri, discussed below in Section 5.2.

5.1 St. Joe State Park

St. Joe State Park is in the old lead belt area near Park Hills, Missouri. The area of the park was donated to the state by the St. Joe Minerals Corporation in 1976 after lead mining in the old lead belt area ceased. The park includes 8238 acres, approximately 2000 acres of which are set aside for off-road vehicle (ORV) riding. About 900-1000 acres within the park are tailings, crushed dolomite remaining from past milling of lead ore. The tailings area within the park is known as the Federal tailings pile. About 800 acres of the tailings are within the ORV area. Lead emissions from areas in the Park are not quantified in emissions inventories. However, windblown dust and/or dust raised by ORV activities are a potential source of airborne lead in and near the Park. Figure 5-2 is an aerial photograph of the St. Joe State Park area in which the tailings area and ORV trails may be seen.

An Environmental Evaluation Cost Analysis (EECA) for remediation of areas within the Park has been drafted, and a work plan will be developed in the future that will include covering areas with greater than 600 parts per million lead in the soil. In addition, areas open to ORV activity may be modified in the future.

5.1.1 Past Monitoring Results

MDNR ESP conducted lead monitoring at three locations in St. Joe State Park from 1993 to 1995. Locations are shown in Figure 5-3. The Missouri Mines site was north of the tailings area at the Missouri Mines historical site. The other sites were south of, but somewhat distant from the tailings area. Figure 5-4 shows monitoring results (calendar quarter average concentrations) from third quarter 1993 through second quarter 1995. Measured concentrations are below the level of the new standard, averaging about 0.06 $\mu g/m^3$. However, reported concentration averages, based on analysis requirements associated with the old standard, may be somewhat lower than would have been measured if the new analysis requirements had been met.

Additional airborne lead measurements are reported in "Human Health Risk Assessment, Federal Tailings Pile Site," St. Francois County, Missouri, 2003, NewFields. These measurements were not designed to determine compliance with NAAQS, but nevertheless are indicative of potential airborne lead concentrations within or near the Park area.

The airborne lead concentrations listed in Table 5-1 were measured at a location identified as Federal Mill Road by MDNR in 1981. Two of these quarterly averages (shown in red) are above the level of the new standard.

Table 5-1. Lead in TSP at Federal Mill Road, 1981

Calendar Quarter	Airborne Lead (µg/m^3)
1st Quarter 1981	0.14
2nd Quarter 1981	1.09
3rd Quarter 1981	0.17

MDNR measured lead concentrations on October1-3, 1992 at nine locations in the Park. On October 3, a motorcycle/ORV race generated visible dust. Measurement results are listed in Table 5-2. These are single day measurements, not quarterly averages, but several of the measured concentrations (shown in red) are above the level of the new standard.

Table 5-2. Lead in TSP at St. Joe State Park, October 1992

Sampler No.	10/1 Airborne Lead (µg/m^3)	10/2 Airborne Lead (µg/m^3)	10/3 Airborne Lead (µg/m^3)
1	0.407	0.387	0.086
2	0.085	0.094	0.036
3	0.211	0.270	0.028
4	0.122	0.109	0.077
5	0.289	0.931	0.662
6	0.100	0.479	0.304
7	0.094	0.112	0.117
8	0.105	0.114	0.085
9 (background)	0.030	0.044	0.025

A contractor measured airborne lead concentrations in 2001 at two sites downwind of the Federal tailings pile to generate data to be used in support of modeling analysis. Results on days with measurable airborne lead are listed in Table 5-3. As above, these are single day measurements (duration from 20 to 24 hours), but, as above, some of the measured concentrations (shown in red) are above the level of the new standard.

Table 5-3. Measurable Airborne Lead Downwind of the Federal Tailings Pile, 2001

Location	9/7 Airborne Lead (µg/m^3)	10/9 Airborne Lead (µg/m^3)	10/18 Airborne Lead (µg/m^3)	10/31 Airborne Lead (µg/m^3)
Horton Whampler	0.189	0.355	0.086	0.463
Kennedy	0.079	0.221	0.098	0.17

A contractor measured time-weighted average airborne lead concentrations on August 3, 1999 using personal samplers worn by two persons riding ORV's in the tailings area of the Park. Results are listed in Table 5-4. These results are not directly comparable to ambient NAAQS, but are nevertheless indicative of airborne lead concentrations.

Table 5-4. Personal Sampler Airborne Lead Concentrations, August 3, 1999

Person	Airborne Lead (µg/m^3)
CH	5.54
JW	6.25

5.1.2 Recommendations for Monitoring

The quarterly average concentrations measured by MDNR ESP in the past are below the level of the new NAAQS. However, the locations of the monitoring sites used for the long-term measurements were not optimal, and the analytical methodology was not consistent with the new standard. Additionally, the various shorter time period measurements listed above indicate that concentrations above the level of the standard are possible at least for short periods. Therefore, it is recommended that MDNR ESP monitor at a location adjacent to the staging area and near the ORV riding area, as indicated in Figure 5-3. Electric power is not available in that area, so that operation of samplers using batteries, solar power, or generators will be necessary. Investigation of methodology is ongoing, but it is hoped that Federal Reference Method (FRM) sampling will be possible despite this limitation.

This recommendation may be modified in the future based on monitoring results and/or on modified designation of ORV areas and site remediation activities. For this reason, and because this location is not at a source characterized by well-known emissions from an ongoing activity, it is preferable that this site be designated as a special purpose monitoring (SPM) site.

5.2 Chat Piles, Tailings Areas, and Remediation Activities

As noted above, there are large chat and/or tailings disposal areas in St. Francois County that resulted from old lead belt mining activities, including Bonne Terre, Desloge or Big River, National, Elvins or River Mines, Leadwood, and Federal (see Figure 5-1). The Federal tailings pile is located within St. Joe State Park, discussed above in Section 5.1. Remediation activities, including moving and covering of material, are currently underway at the National chat pile in Park Hills, Missouri. Remediation at other areas has either been completed or is planned for the future.

5.2.1 Monitoring Results

Air monitoring, including lead monitoring, is being done daily on work days at four locations near the National chat pile during earthmoving operations:

- Ozark, northeast of the site,
- Soccer fields, southeast of the site,
- Water plant, southwest of the site,
- Big River, northwest of the site.

Figure 5-5 shows the National chat pile and the locations of the monitoring sites. Figure 5-6 is a closer view of the National site. As may be seen in the figures, there is a residential area very near the pile to the southwest.

Table 5-5 lists measured lead concentrations during the second quarter of 2008 at these monitoring sites. Measurements are done by a contractor and reported to MDNR and EPA. Concentration results for filters with less than 65 µg lead, corresponding to approximately 0.04 $\mu g/m^3$, are reported as zero, which results in averages being lower than they would be if a lower detection limit and reportable concentration were required. Therefore, average concentrations are artificially low. Single day concentrations greater than the level of the new standard are shown in red. These measurements do not indicate violation of the standard, since the standard applies to a three-month average.

Table 5-5. Airborne Lead Concentrations Measured Near the National Chat Pile, Second Quarter 2008

Date	Ozark ($\mu g/m^3$)	Soccer Field ($\mu g/m^3$)	Water Plant ($\mu g/m^3$)	Big River ($\mu g/m^3$)
5/22	0.000	0.000	0.000	0.000
5/23	0.000	0.000	0.000	0.000
5/27	0.000	0.000	0.000	0.038
5/28	0.000	0.063	0.000	0.044
5/29	0.043	0.000	0.000	0.000
5/30	0.126	0.000	0.000	0.000
6/2	0.000	0.000	0.000	0.000
6/3	0.000	0.143	0.000	0.052
6/5	0.000	0.123	0.000	0.048
6/6	0.000	0.047	0.000	0.097
6/9	0.000	0.079	0.000	0.155
6/10	0.000	0.039	0.000	0.000
6/11	0.000	0.047	0.000	0.039
6/12	0.000	0.112	0.000	0.106
6/13	0.000	0.000	0.000	0.000
6/16	0.000	0.113	0.159	0.080
6/17	0.097	0.100	0.000	0.092
6/18	0.181	0.117	0.041	0.061
6/19	0.161	0.000	0.000	0.000
6/20	0.000	0.000	0.000	0.000
6/23	0.000	0.076	0.000	0.000
6/24	0.186	0.000	0.000	0.000
6/25	0.267	0.000	0.000	0.000
6/26	0.213	0.000	0.000	0.058
6/27	0.184	0.000	0.000	0.000
6/30	0.000	0.168	0.085	0.000
Average	**0.056**	**0.047**	**0.011**	**0.033**

Average concentrations for the quarter at the two sites nearest to the chat pile are about one-third of the new standard, even with the concentrations below about 0.04 $\mu g/m^3$ reported (and averaged) as zero.

Lead concentrations have also been measured near other chat piles or tailings areas during remediation activities. For example, concentrations at monitoring sites near the Desloge site averaged about 0.1 $\mu g/m^3$, or about two-thirds of the new standard ("Air Dispersion Modeling of Mine Waste in the Southeast Missouri Old Lead Belt," M. L. Abbott, Idaho National Engineering and Environmental Laboratory, Bechtel BWXT Idaho, LLC, October 1999, INEEL/EXT-99-00235).

5.2.2 Recommendations for Monitoring

The measured concentrations discussed above indicate probable compliance with the new standard at the current monitoring sites, but average concentrations are as high as one-third of the new standard, even with the concentrations below about 0.04 $\mu g/m^3$ reported (and averaged) as zero. Also, as may be seen in Figures 5-5 and 5-6, there are residents closer to the National chat pile than are the monitoring sites. Therefore, it is recommended that MDNR ESP monitor at a location near the National chat pile. The recommended site, near the intersection of Industrial Drive and Parkway Drive, is generally downwind of the pile.

This recommendation may be modified in the future based on monitoring results and/or on site remediation activities. For example, remediation activities at Leadwood may be resumed in the future, and monitoring in that area may be desirable. Because this location is not at a source characterized by well-known emissions from an ongoing activity, it is preferable that this site be designated as a special purpose monitoring (SPM) site.

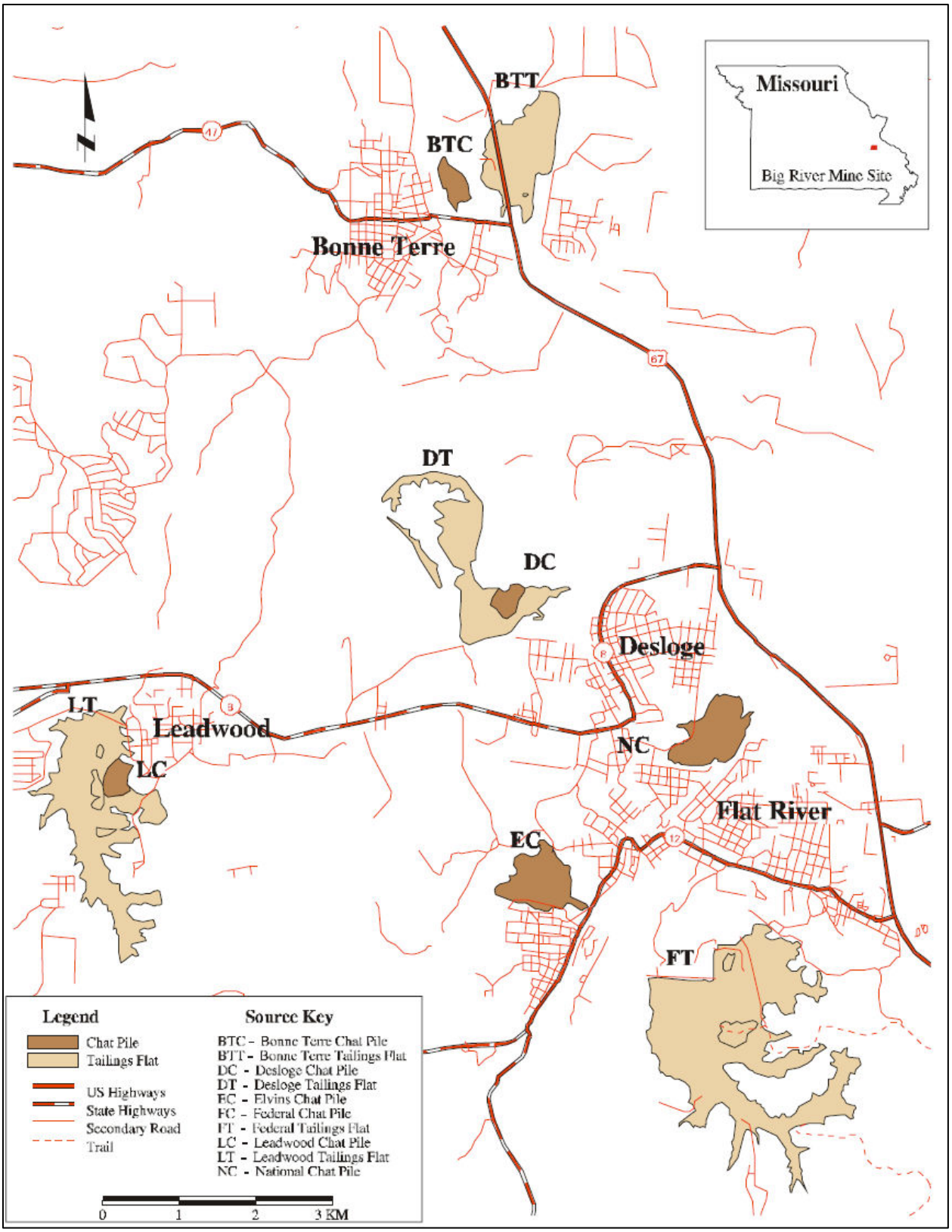


Figure 5-1. Major Chat piles and tailings areas in the Old Lead Belt, Missouri.

Figure 5-2. Aerial photograph of St. Joe State Park. The tailings area and ORV trails may be seen quite clearly.

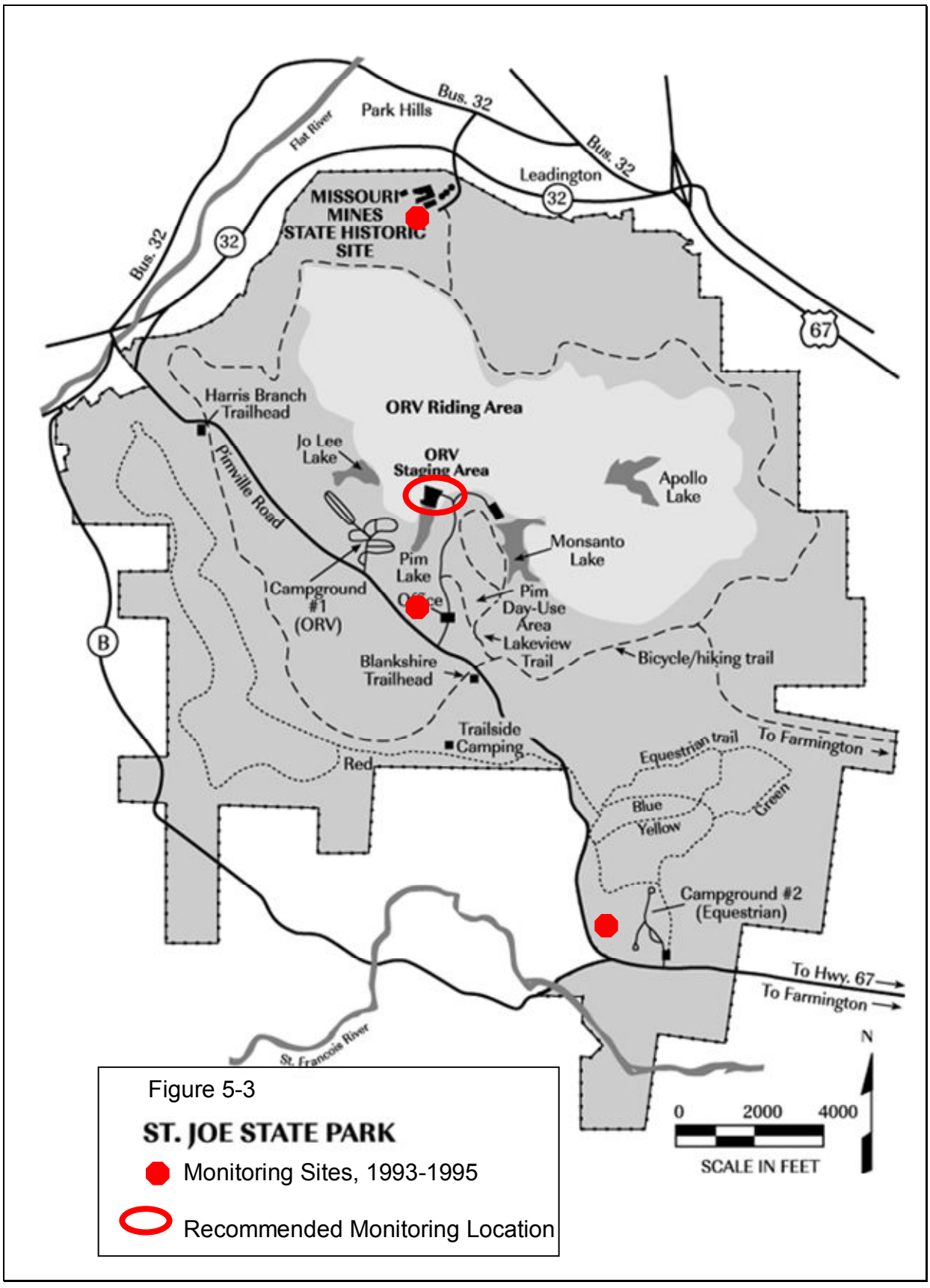


Figure 5-3

ST. JOE STATE PARK

Monitoring Sites, 1993-1995

Recommended Monitoring Location

Figure 5-4. St. Joe State Park Airborne Lead Concentrations, Calendar Quarter Averages

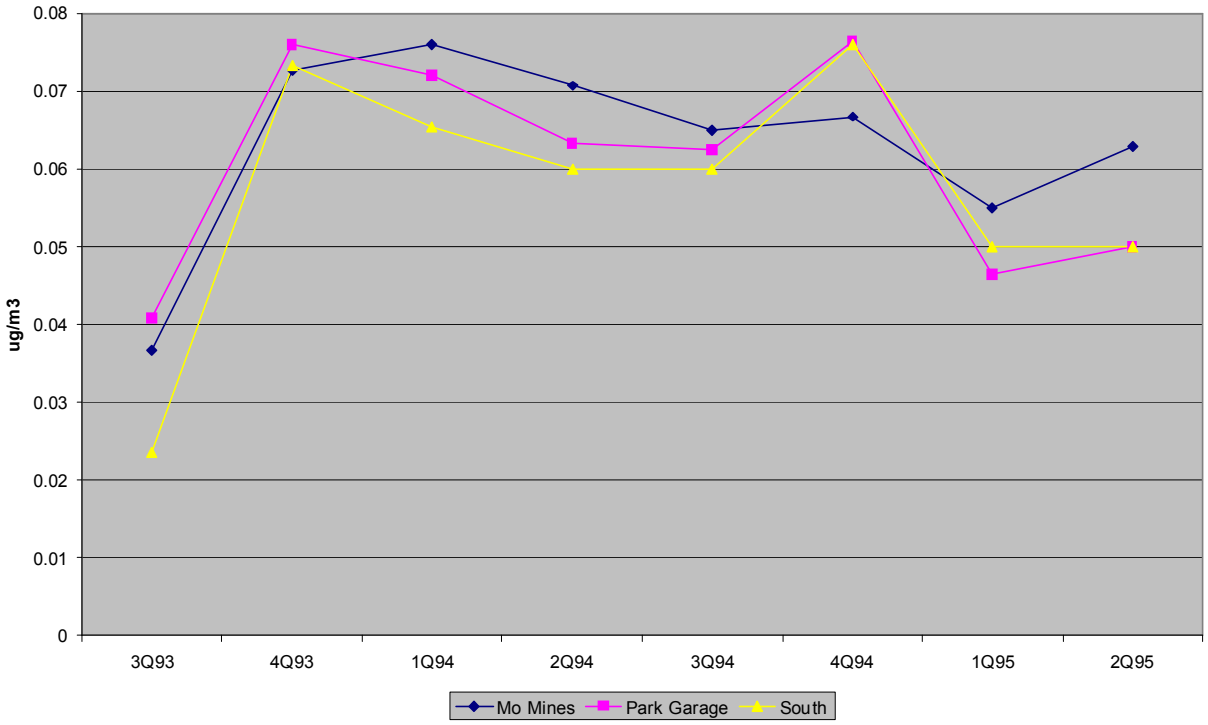


Figure 5-5. National site and air monitoring stations.

Figure 5-6. Closer view of the National site and recommended monitoring site (red dot).

6.0 TRI-STATE LEAD MINING AREA

Lead and zinc were mined in the tri-state area (southwestern Missouri, southeastern Kansas, and northeastern Oklahoma) between about 1830 and the 1970s. Chat and tailings from the mining and milling have remained in the area following cessation of mining activity.

Within Missouri, mining in the tri-state area occurred within Jasper and Newton Counties. Eleven separate areas within Jasper and Newton Counties were listed on the National Priorities or Superfund list in 1990. These areas are known collectively as the Oronogo/Duenweg Mining Belt Superfund Site, also sometimes called the Jasper County Site. Figure 6-1 shows the locations of these areas. Remediation activities are categorized under five operable units (OU). Remediation activities within OU 2 and 3, Residential Yard Soils, included cleanup activities completed in 2002 and institutional controls established in 2005. Activities within OU 4, Groundwater, were completed in 2004 with the installation of public water supply systems. OU 5 relates to the Spring River basin and is currently under study. OU 1 is mine and mill waste. Remediation activities within OU 1 have recently begun and will continue for several years. The remediation includes removal of contaminated material with contaminant concentrations above established thresholds and disposing of it in mining pits and in repository areas that will be capped and vegetated. ("PSE 440- Case Discussion Nov. 28, 2006, Remediation to Reduce Ecological Risk from Trace Element Contamination," Gary M. Pierzynski and Grace C. Vaillant, www.umaine.edu/pse/sc/Remediation%20toPSE%20440-Case%20Study%20Reduce%20Ecological%20Risk%20from%20Trace%20Element%20Contamination.pdf; "Second Five-Year Review, Oronogo-Duenweg Mining Belt Site, Jasper County," Missouri, US EPA Region VII, 2007; and cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701290)

6.1 Monitoring Results

Air monitoring was conducted in July and August 1993 at sites in the Joplin and Oronogo/Duenweg areas (see Figure 6-1) and reported in the remedial investigation/feasibility study for the Jasper County Site, prepared by a contractor for EPA. Sites were selected based on the presence of chat and tailings, the presence of material with elevated exposed surface areas, and open areas free of obstructions. These measurements were not, of course, intended to measure compliance with the new NAAQS, so that detection limits and precision were likely not consistent with present requirements. Table 6-1 lists lead concentrations measured with a TSP sampler at the Joplin location. The higher value on 8/22/1993 appeared to result from a trespassing motorcycle riding near the sampler. All measured concentrations measured with a TSP sampler at the Oronogo/Duenweg site were reported as less than 0.05 or 0.07 $\mu g/m^3$. Lead concentrations were also measured with a PM_{10} sampler; the concentrations were 0.22 $\mu g/m^3$ and 0.49 $\mu g/m^3$ on 8/21 and 8/22/1993 respectively. All other PM_{10} lead concentrations at the Joplin site and all concentrations at the Oronogo/Duenweg site were reported as less than 0.05 or 0.06 $\mu g/m^3$.

Sampling was also done at the Oronogo/Duenweg site using a motorcycle rider and all-terrain vehicle rider wearing personal sampling pumps while riding on the site. Lead was not detected

in the samples, but lead analysis was not very sensitive. Lead concentrations were reported as ranging from less than 14 to less than 17 µg/m^3. No other airborne lead measurements on or near the areas of the Superfund site have been identified to date.

Table 6-1. Airborne Lead Concentrations in the Joplin area of the Jasper County Superfund Site

Date (1993)	Airborne Lead Concentration (µg/m^3)
7/22	<0.05
7/23	<0.05
7/24	0.07
7/25	0.06
7/26	<0.05
7/27	<0.05
7/28	0.08
7/29	<0.04
7/30	0.06
7/31	0.09
8/1	<0.05
8/2	<0.06
8/3	<0.05
8/4	<0.05
8/5	<0.05
8/6	<0.05
8/9	0.10
8/10	<0.05
8/11	0.09
8/12	0.07
8/13	<0.05
8/14	<0.05
8/15	<0.05
8/16	<0.05
8/17	<0.05
8/18	<0.05
8/19	0.22
8/20	0.06
8/21	0.72
8/22	1.21
8/23	<0.05

6.2 Recommendations for Monitoring

The limited airborne lead measurements summarized above do not suggest violation of the new lead NAAQS. However, the TSP and PM_{10} measurements were not made during remediation or earthmoving activity, but primarily measure windblown dust, with the exception of the one day

when there was observation of motorcycle riding in the area near the sampler. And, as noted above, the methodology used for these measurements probably did not have detection limits and precision consistent with present requirements Also, the personal sampler measurements did not have sufficient analytical sensitivity to measure concentrations approaching the level of the NAAQS. Therefore, it is recommended that MDNR ESP conduct airborne lead monitoring at a location within ambient air as close as practicable to remediation activity such as earthmoving and generally downwind of the activity. The recommended location (near the intersection of Main Street/Highway D and Hawthorne Road in Webb City) is near the northern end of the Oronogo/Duenweg area shown in Figure 6-1, where remediation activity is planned to occur over at least the next year. The site is indicated in Figure 6-2, which also clearly shows much of the area that is being remediated.

This recommendation may be modified in the future based on monitoring results and/or on site remediation activities. Because this location is not at a source characterized by well-known emissions from an ongoing activity, it is preferable that this site be designated as a special purpose monitoring (SPM) site.

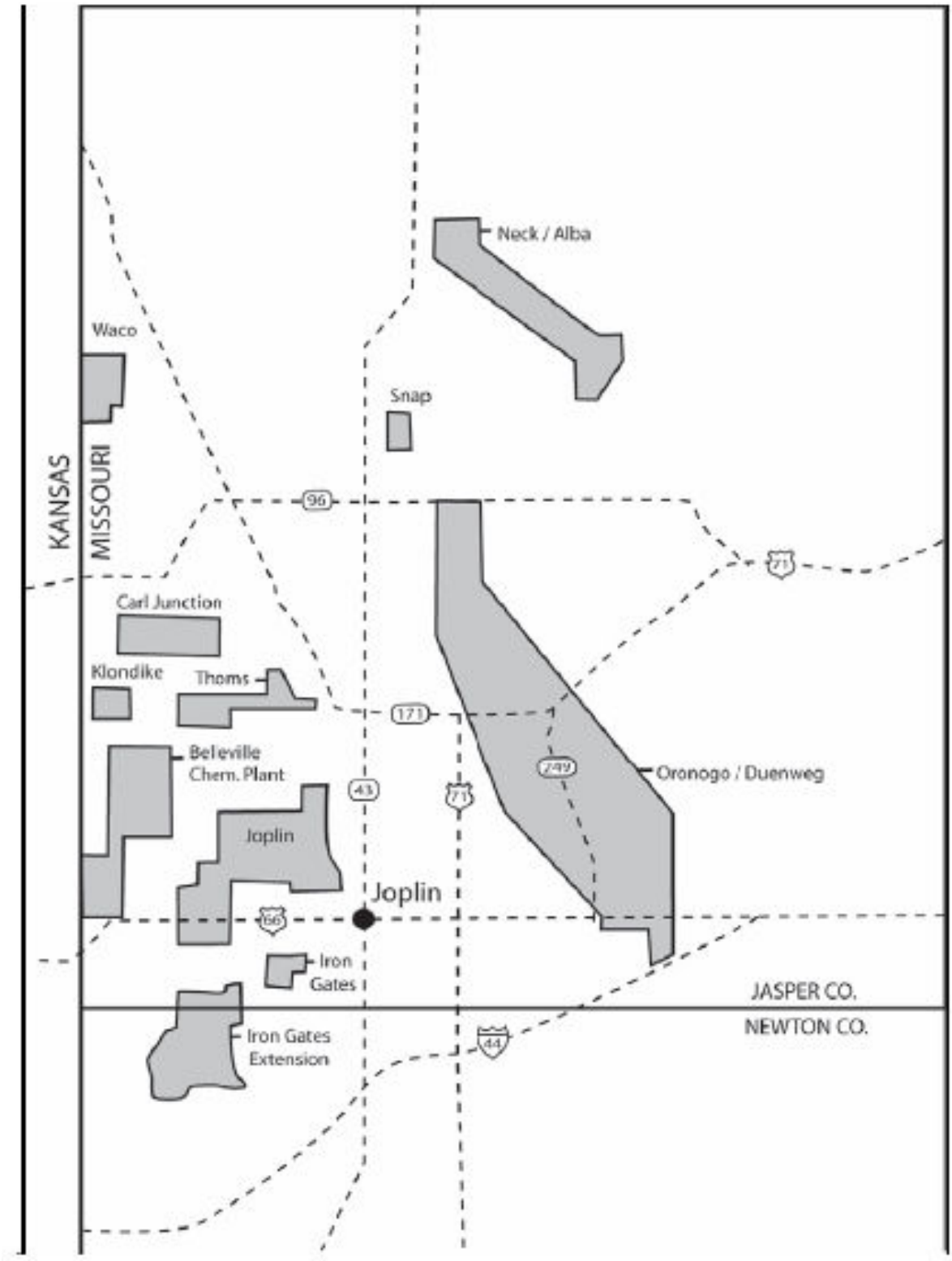


Figure 6-1. Locations of the 11 areas comprising the Oronogo/Duenweg Mining Belt Superfund site.

Figure 6-2. Oronogo/Duenweg remediation area (light areas) and recommended monitoring site (red dot).

7.0 OTHER LEAD SOURCES

Several other potential lead sources in Missouri were identified as a part of the review of emission inventory information, but eliminated from further consideration after evaluation resulted in emission estimates less than one ton per year, as discussed in Section 2.0. These sources included utility plants, cement plants. General aviation airports in Missouri were also eliminated from further consideration based on EPA estimates of lead emissions from aircraft using those airports being less than one ton per year. Another identified source where monitoring was done in the past is the facility in Holt County formerly known as Schuylkill Metals, now known as the Exide Technologies Canon Hollow Plant. This facility is a secondary smelter for recycling of lead, primarily from lead acid storage batteries.

7.1 Monitoring Results

Air monitoring was conducted near the Schuylkill Metals (now Exide Technologies) facility from 1992 to 2000. Figure 7-1 shows quarterly average airborne lead concentrations measured at three sites near the facility. Data are plotted at the month beginning each quarter. The north site showed a violation of the old NAAQS in the third quarter of 1994 and concentrations that were a significant fraction of the standard in other quarters. That site was subsequently included within the plant site, so that it was no longer considered ambient.

7.2 Recommendations for Monitoring

Current emission estimates for the Exide Technologies (formerly Schuylkill Metals) facility have been evaluated, and APCP staff visited the facility in early 2009. Emission controls, including control of fugitive emissions, have been improved at the facility since the time of the monitoring described above, and lead emissions are estimated to be less than one ton per year. Source test results confirm that emissions have been reduced, indicating a 96 percent reduction since monitoring was discontinued. It is therefore unlikely that ambient lead concentrations exceed the new NAAQS, and resumption of ambient monitoring near this facility is not recommended.

8.0 METROPOLITAN AREA MONITORING

The requirement for urban area monitoring applies to the St. Louis and Kansas City areas in Missouri (see Section 1.1). Monitoring in those areas must begin by January 1, 2011. Lead monitoring is currently being done at the Clayton Station in St. Louis County. That monitor will soon be relocated to the Ladue Station, which is immediately adjacent to the Clayton site, so that, in effect, monitoring will be continued at that same location.

Lead monitoring is not currently being done in the Kansas City area. The monitoring plan (successor to this document) that will be submitted to EPA on July 1, 2010 will include evaluation of the St. Louis area site and plans for establishing a lead monitoring site in the Kansas City area by January 1, 2011.

9.0 SUMMARY AND CONCLUSIONS

On October 15, 2008, the United States Environmental Protection Agency (EPA) revised the level of the primary National Ambient Air Quality Standard (NAAQS) for airborne lead from 1.5 micrograms per cubic meter ($\mu g/m^3$) to 0.15 $\mu g/m^3$, calculated as three-month rolling averages. At the same time, EPA revised airborne lead monitoring requirements to require, at a minimum, monitoring in areas potentially impacted by sources of lead emissions greater than or equal to one ton per year. These source-oriented monitors must be operational by January 1, 2010. A plan for implementation of this monitoring (the previous version of this document) was submitted to EPA on July 1, 2009 as required.

Emission inventory data for sources identified as emitting one-half ton per year or more have been reviewed and updated to identify lead sources in Missouri that emit one ton per year or more. Identified sources include the Herculaneum, Glover, and Buick smelters and the mine/mill complexes at Buick, Brushy Creek, Fletcher, and Sweetwater, all operated by the Doe Run Company. Emissions from the Sweetwater facility may be less than one ton per year but are uncertain, so monitoring near that facility is recommended.

In addition to these identified sources, there are areas of former lead mining and processing in Missouri that have remaining waste materials that contain lead. Emissions from these areas have not been quantified, but they are also candidate areas for airborne lead monitoring.

Herculaneum Area

The Missouri Department of Natural Resources Environmental Services Program (MDNR ESP) currently operates lead monitors at five sites near the Herculaneum Smelter: Bluff, Broad Street, Circle Street, Dunklin High School, and Main Street. The current network is more dense than necessary in the immediate vicinity of the smelter, and does not extend far enough to define the extent of the area that may not be in compliance with the new standard. Therefore, the following changes are recommended:

- Discontinue MDNR monitoring at the Broad Street site, which is now inside the facility fence line;
- Discontinue MDNR monitoring at the Circle Street site, which is now inside the facility fence line;
- Discontinue MDNR monitoring at the Bluff site; move the MDNR Bluff sampler to Sherman and reduce sampling frequency to one day in six;
- Re-establish the Pevely site near the Dow plant;
- Establish a new north site, also in Pevely;
- Establish a new south (background) site.

This is a net increase of one state monitoring site in the Herculaneum area. It is also recommended that one Doe Run site (Main St/City Hall) be relocated slightly, and that three of the Doe Run Company sites in the Herculaneum area can be discontinued.

New Lead Belt and Related Facilities

The Buick Smelter, the four mine/mill complexes listed above, and the Glover facility are identified as sources possibly emitting more than one ton of lead per year. The only current monitoring in these areas is being done by the Doe Run Company near the Buick Smelter and Glover facility. To meet the requirements of the new monitoring regulations, it is recommended that MDNR ESP establish a network of five new sites in the Viburnum Trend area and one new site in the Glover area:

- North of the Buick smelter;
- South of the Buick Mine/Mill facility;
- Near the Brushy Creek mine/mill;
- Near the Fletcher Mine/Mill;
- Near the Sweetwater Mine/Mill;
- Near the Glover facility.

Old Lead Belt Area

Sites in the Old Lead Belt are not identified as greater-than-one-ton emitters, but intermittent past monitoring activity indicates the potential for airborne lead concentrations at levels comparable to the new standard. Therefore, it is recommended that MDNR ESP establish two new sites:

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- In St. Joe State Park near tailings areas that are used for off-road vehicle activity;
- In Park Hills near remediation activity at the National site.

Tri-State Mining Area

As in the Old Lead Belt area, sources are not identified, but intermittent past monitoring activity and the nature of the current remediation activity indicate the potential for airborne lead concentrations that should be monitored. Therefore, it is recommended that MDNR ESP establish one new site:

- Near remediation activity on the Oronogo/Duenweg site in southwest Missouri.

Conclusions

This plan recommends a total of ten new MDNR ESP-operated lead monitoring sites in Missouri in addition to the five current and/or relocated sites in the Herculaneum area. The general areas of these sites are indicated on a State map in Figure 9-1. A table of latitude and longitude coordinates of all sites is included in the appendix. Each of these sites will be operated every sixth day on the standard schedule. The size of the statewide network will require collocated sampling at two locations. Collocated sampling is currently done at the Main Street site in Herculaneum. Collocated sampling will be added at one of the new sites, probably the new site north of Buick.

Schedule

Development and implementation of this plan include the following elements:

- Draft plan development, completed at the end of May 2009;
- Making the plan available for public review and comment, completed during June 2009;
- Submission of the plan to EPA, completed July 1, 2009;
- Selection of monitoring sites, including agreements with landowners, June through September 2009; EPA staff accompanied MDNR staff on some site selection trips and have been kept informed of site selection activity and locations;
- Plan revision in response to comments and including identification of sites, July through September 2009;
- Procurement of samplers, July through November 2009;
- Revision of the data base for lead monitoring data to accommodate new sites and revised monitoring and analysis requirements, July through October 2009;
- Testing and standardization of laboratory analytical methods to be consistent with the new monitoring requirements, January through December 2009,
- Site installation, including installation of electric power and samplers, September through December 2009.

The short time remaining for implementation of this plan will require continued close coordination with EPA as review of this plan and site installation proceed.

In addition to the ten new sites listed above, the 2010 lead monitoring plan will call for establishing a new lead monitoring site in the Kansas City area by January 1, 2011.

Site Selection Criteria

This plan describes the locations of sites, which were selected based on the following criteria:

- Sites should be in ambient air, i.e., in areas accessible to the public, and, where practicable, in populated areas;

- Sites should meet established criteria with respect to distance from obstructions, etc.;

- Sites should generally be downwind of sources. Ideally, a site should be near the point of maximum modeled impact of a source, but complex topography, land ownership, and availability of utilities will require flexibility in applying this condition;

- Sites must, of necessity, be located in areas accessible by road, where electric power is available, and where land use at reasonable cost can be obtained.

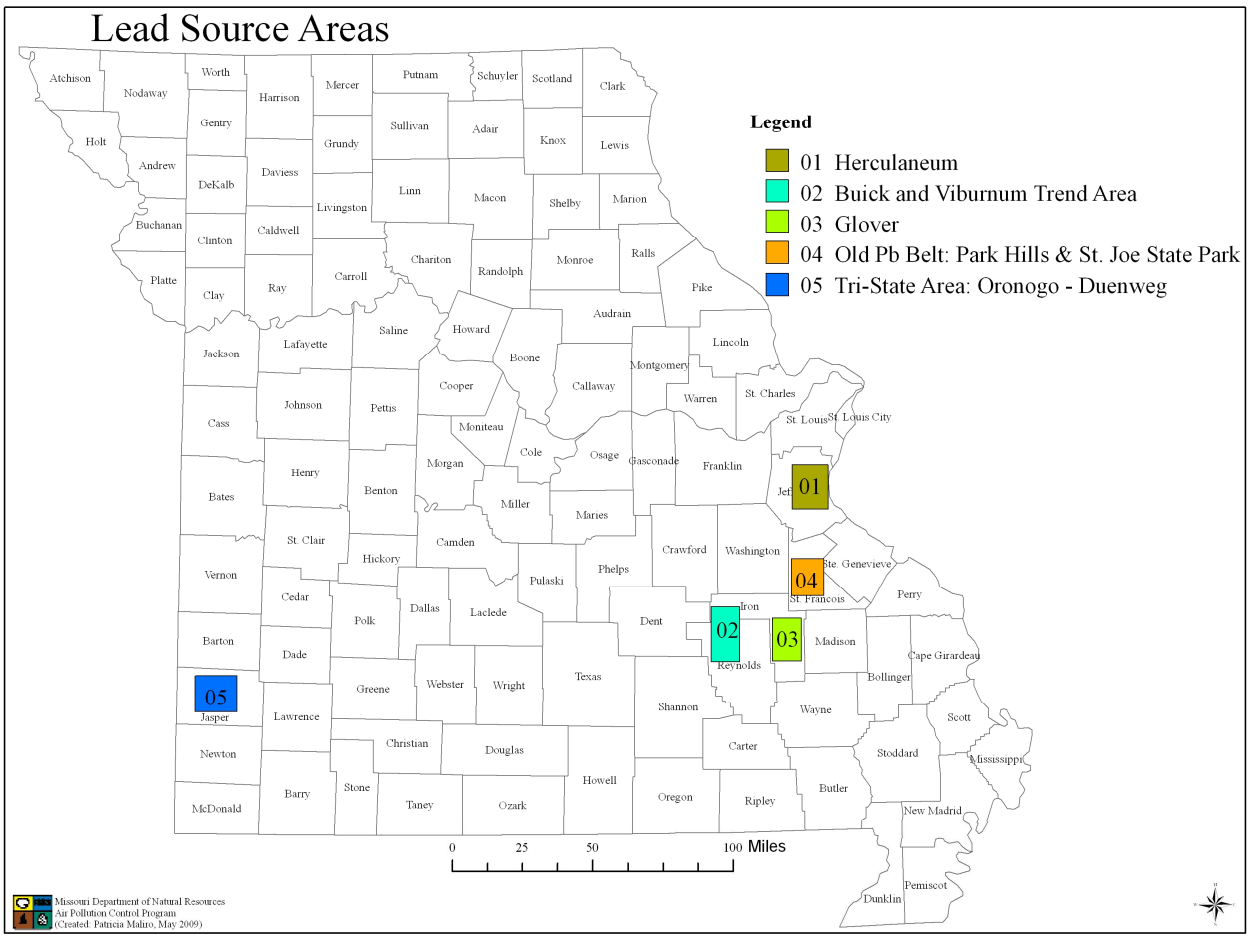

Figure 9-1. Current and Proposed Lead Air Monitoring Areas.

APPENDIX: COORDINATES OF RECOMMENDED MONITORING SITES

Locations of Proposed New State of Missouri Lead Monitoring Sites

Area/Site Description	Latitude, Degrees North	Longitude, Degrees West
Herculaneum		
Sherman Drive (relocation from Bluff)	38.27171	-90.37652
Pevely*	38.28610	-90.38094
Pevely North*	38.29612	-90.39235
South (near Ursuline Provincialate, Glennon Heights Road)**	38.24300	-90.37371
New Lead Belt (Buick, Viburnum Trend, Glover)		
Highway 32 (Iron County, between Boss and Bixby, east of Highway KK intersection)	37.65310	-91.13152
Highway KK (Reynolds County, north of Highway J intersection)	37.56488	-91.11428
Bills Creek (Reynolds County Road 908, approx. 3 miles North of County Road 906)	37.53464	-91.14853
Fletcher (Reynolds County Road 849/Forest Road 2236, approx. 1.5 miles miles east of Highway TT)	37.46953	-91.08943
Highway B (Reynolds County, approx. 4 miles south of Highway 72)	37.36414	-91.12226
Glover Baptist Church (Iron County, Highway 49, approx. 0.4 mile south of Highway 21/49/72 intersection)	37.48964	-90.69246
Old Lead Belt		
St. Joe State Park (St. Francois County, ORV Staging Area)	37.81413	-90.50738
Park Hills (St. Francois County, Parkway Drive and Industrial Drive)	37.86485	-90.50804
Tri-State Mining Area		
Webb City (Jasper County, North Main Street/Highway D and Hawthorne Road)	37.16996	-94.46313

*Sites determined after 8/31/2009 revised plan

**Site relocated slightly from 8/31/2009 revised plan